US Army Corps of Engineers®
Savannah District

Glades Reservoir Draft Environmental Impact Statement

Chapter 2

Alternatives Analysis

October 2015

2 ALTERNATIVES ANALYSIS

LIST OF TABLES

LIST OF FIGURES

2 ALTERNATIVES ANALYSIS

2.1 Introduction

The Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations (CFR) 1502.14(a)) for implementing the National Environmental Policy Act (NEPA) and the U.S. Army Corps of Engineers (Corps) NEPA Implementation Procedures (33 CFR 325 **Appendix B**) require that a reasonable range of alternatives be considered, including Hall County's (the Applicant's) Proposed Project. The alternatives analysis addresses this requirement by identifying and screening water supply alternatives in order to select Draft Environmental Impact Statement (DEIS) alternatives for further evaluation per public interest factors (33 CFR 320.4(a)) (Chapters 3 and 4).

The CEQ NEPA regulations require that an EIS "rigorously explore and objectively evaluate all reasonable alternatives" (40 CFR 1502.14(a)). In determining the range of reasonable alternatives to be considered, the CEQ states: "the emphasis is on what is **reasonable** rather than on whether the proponent or Applicant likes or is itself capable of carrying out a particular alternative." Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint using common sense, rather than simply desirable from the standpoint of the Applicant" [Memorandum to Agencies: Forty Most Asked Questions Concerning CEQ's NEPA Regulations, Question 2a; 46 Fed. Reg. 18026 (March 23, 1981)]. Under NEPA, comparing a full alternative spectrum should provide a clear basis for choice among options for the decision maker and the public (40 CFR 1502.14).

For Corps permit actions, the alternatives analysis should comply with the Clean Water Act (CWA) Section 404(b)(1) Guidelines (40 CFR Part 230). These guidelines specifically require: "no discharge of dredged or fill material shall be permitted if there is a **practicable** alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant environmental consequences" (40 CFR 230.10(a)). This requirement is commonly known as the least environmentally damaging practicable alternative (**LEDPA**). An alternative is considered practicable if it is: "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.10(a)).

Since the guidelines define the aquatic ecosystem as waters of the United States, including wetlands, jurisdictional issues apply when relating to the guidelines. However, due to the large number of initial alternatives and subsequent considerable effort required to determine jurisdiction, all waters were evaluated irrespective of jurisdiction during the early screening. The alternatives must satisfy the guidelines and the public interest review (33 CFR 320.4(a)). Therefore, for Corps permitting actions, the range of practicable alternatives is typically a sub-set of reasonable alternatives under NEPA. According to Corps regulations, the alternatives analysis for actions subject to NEPA and the guidelines can be integrated simultaneously to ensure alternatives carried forward for analysis are practicable, and the LEDPA has not been eliminated from further consideration. The alternative comparisons should: "allow a complete and objective evaluation of the public interest and a fully informed decision regarding the permit application" (33 CFR 325 **Appendix B** .9(b)(5)).

The alternatives screening process for the Glades Reservoir EIS was conducted in accordance with both NEPA and the Section 404(b)(1) Guidelines. A range of water supply components were gathered from input received during the scoping process for this EIS. The identification, verification, evaluation, and screening of all known alternative components was conducted by the Corps, with review and input from the Environmental Protection Agency (EPA) and Georgia Environmental Protection Division (EPD) as cooperating agencies.

This alternatives analysis represents a substantial technical comparison of the Proposed Project to other options for achieving the purpose and need presented in Chapter 1. Chapter 2 describes the following:

- Alternatives identification and screening process
- Identification and screening of components
- Formulation and screening of alternatives from screened components
- Overview of identified EIS alternatives
- Preliminary engineering construction logistics and estimated build costs
- EIS alternatives comparative analysis

2.2 Overview of Alternatives Identification and Screening Process

The alternatives identification and screening process for this EIS is a three-phased approach (**Figure 2.1**) developed based on the guidelines summarized in Section 2.1:

Phase 1 – Water Supply and Infrastructure Components

1A. Identification and screening of components for feasibility through comparison against practicability criteria, focusing on purpose and need, existing technology, logistics, cost, environmental consequences, and institutional issues

1B. Preliminary environmental screening of identified new reservoir sites, including analysis of potential impacts to aquatic resources, other impacts, and comparison of environmental factors described in the Corps Guidelines

Phase 2 – Water Supply Alternatives

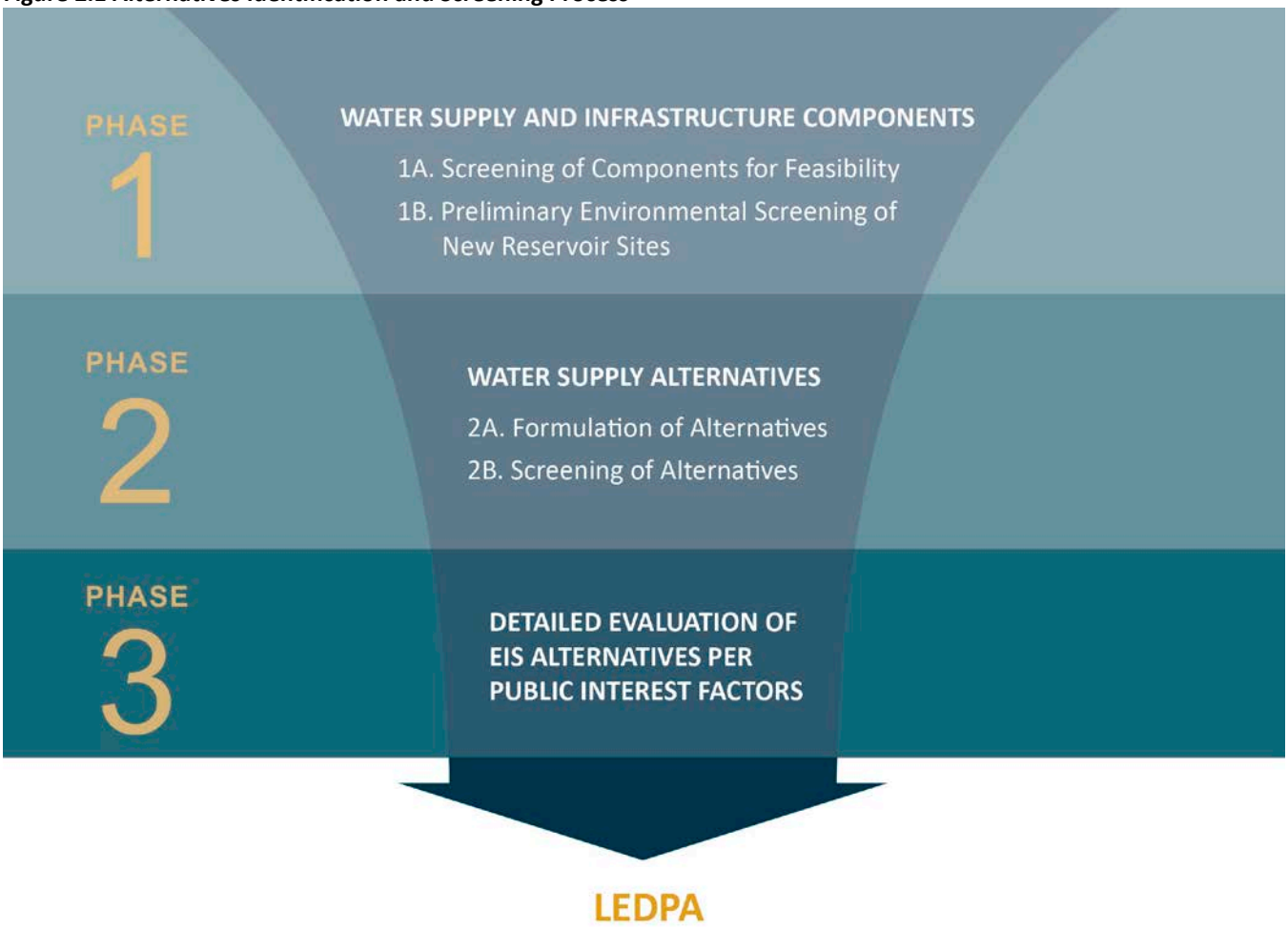
2A. Formulation of alternatives by combining various screened components

2B. Screening of alternatives through quantitative and qualitative comparison to assess impacts; comparison of impacts to aquatic environment; and elimination of alternatives with higher impacts

Phase 3 – Detailed Evaluation of EIS Alternatives per Public Interest Factors

This chapter covers Phase 1 and Phase 2; Phase 3 evaluation is presented in Chapters 3 and 4. The overall goal of the three-phase process is to yield a manageable number of practicable and reasonable water supply alternatives that will lead to the determination of a LEDPA. Sections 2.3 to 2.5 provide descriptions of the alternative analysis in further details.

Figure 2.1 Alternatives Identification and Screening Process



2.2.1 Potential Water Supply and Infrastructure Components

The identification of alternatives began by developing a list of potential water supply sources and infrastructure "components." Meeting long-term water supply needs (see Chapter 1.2 Applicant's Stated Purpose and Need) often involves implementation of multiple actions, defined as "components" in this EIS, which include a wide array of potential water supply sources and infrastructure options for transporting and/or treating the water from supply sources.

A literature review was conducted to identify potential components based on the Applicant's Proposed Project (404 permit and supplemental information), existing local and regional studies and plans, comments received during the Scoping process, and input from cooperating agencies. **Table 2.1** summarizes the categories of water supply components used in this EIS. Each of these components is screened for feasibility based on practicability criteria.

After the initial identification and screening of all components for feasibility (Phase 1A), a preliminary environmental screening (Phase 1B) was conducted for identified new reservoir sites, including analysis of potential impacts to aquatic resources, other impacts, and comparison of environmental factors described in the

404(b)(1) Guidelines. Components that passed the Phase 1 screening are used to formulate water supply alternatives.

Table 2.1 Categories of Water Supply Sources and Infrastructure Components

Category	General Description
Groundwater[1]	Maximize the use of existing groundwater sources and develop new groundwater supply sources.
Water Purchase[2]	Purchase water from one of Hall County's nine neighboring counties (Banks, Barrow, Dawson, Forsyth, Gwinnett, Habersham, Jackson, Lumpkin, or White counties).
Additional Conservation[3]	Implement additional water conservation measures to manage future water demand, including water loss reduction and other conservation programs and measures.
Reuse/Recycle	Obtain additional water supply through beneficial water reuse or recycling. This can include increasing indirect reuse such as discharging treated wastewater effluent into a water supply source; urban irrigation, process water recycling and direct reuse.
Lake Lanier Additional Storage Allocation/ Exchange	Obtain additional water supply allocation from Lake Lanier, or exchange of water supply allocation from Lake Lanier with storage from construction of a new reservoir in a different basin
Regional Sources	Obtain water from regional sources (other than Lake Lanier) such as West Point Lake, Lake Rabun, Lake Burton, Lake Hartwell, or the Tennessee River.
Expansion of Existing Reservoirs	Expansion of existing reservoirs by raising the dam height (Cedar Creek Reservoir) or raising the water surface levels (Lake Lanier).
New Reservoirs	Construction of a new surface water source (reservoir) for water supply. Water would be pumped from a river source and stored in the new reservoir for water supply purposes.
Quarry Storage	Convert existing quarries into water supply storage reservoirs. Water would be pumped from a river source and stored in the quarry for water supply purposes.

[1]Described in the Groundwater Availability Technical Memorandum, Appendix F
[2]Described in the Water Purchase Technical Memorandum, Appendix H
[3]Described in "The Corps' Need Analysis," Chapter 1.6

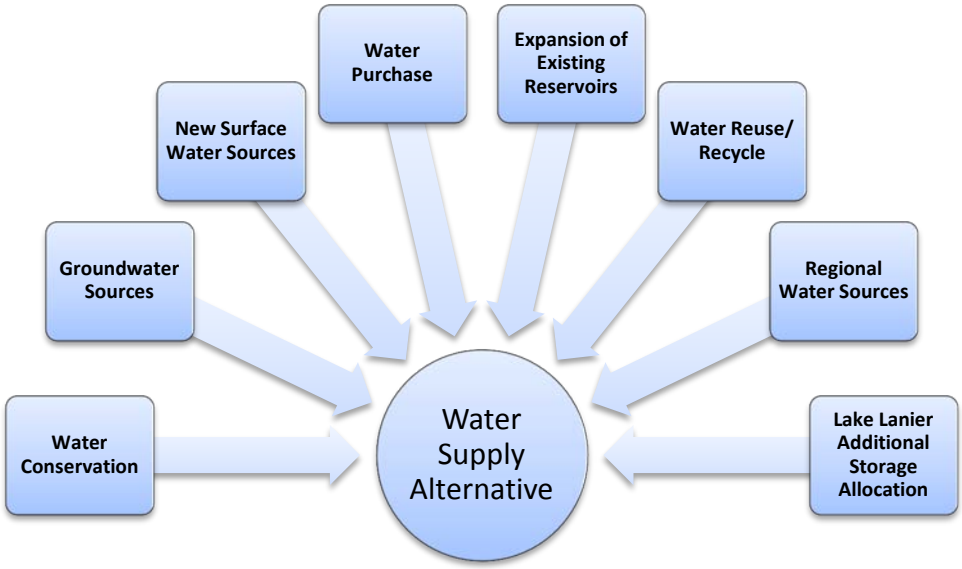
2.2.2 Water Supply Alternatives

In Phase 2, screened water supply components are combined to formulate water supply alternatives **Figure 2.2,** followed by screening of these alternatives. The process for formulating each alternative began with assessing the unmet need of Hall County by comparing Hall County's existing water supply availability and its projected 2060 demand.

With an estimate of how much water can be provided from each screened component, components were selected systematically to build each alternative that could meet the project purpose and need. Every alternative was formed with these priorities:

- First, maximize practices that will provide additional supply with no or minimal impacts to aquatic ecosystem (ex: policy decisions like new water conservation programs)
- Second, select components that will involve minor construction and impacts (ex: purchasing water from an adjacent provider or building new groundwater wells)
- Lastly, move toward major projects such as construction of new surface water sources (reservoirs and other associated pumping and transmission infrastructure)

Figure 2.2 Combining One or More Water Supply Components to form Water Supply Alternatives



It is assumed that water supply components with less environmental impacts will be exhausted prior to moving forward with construction of a major water supply project. Therefore, all water supply alternatives included these basic components: Lake Lanier additional allocation, additional water conservation, Cedar Creek Reservoir (already constructed but has not been needed for water supply to date), water purchase (from adjacent county), and additional groundwater supplies.

2.3 Phase 1: Water Supply Infrastructure Components

A total of 56 potential water supply sources and infrastructure components were identified within the "Phase 1 List" (**Table 2.2** and **Figure 2.3**). The complete list with additional component details is included as **Appendix I** Maps of the conceptually developed reservoir sites is included in **Appendix J**.

Table 2.2 Phase 1 List of Water Supply Components

ID	Name	Location/General Description	County	Basin
WP-001	Forsyth County	Potential water purchase from Forsyth County	Forsyth	Chattahoochee
WP-002	Gwinnett County	Potential water purchase from Gwinnett County	Gwinnett	Chattahoochee
WP-003	Habersham County	Potential water purchase from Habersham County	Habersham	Chattahoochee/ Savannah
WP-004	White County	Potential water purchase from White County	White	Chattahoochee
WP-005	Jackson County	Potential water purchase from Jackson County	Jackson	Oconee/Savannah
WP-006	Dawson County	Potential water purchase from Dawson County	Dawson	Chattahoochee/Coosa
WP-007	Lumpkin County	Potential water purchase from Lumpkin County	Lumpkin	Chattahoochee/Coosa
WP-008	Banks County	Potential water purchase from Banks County	Banks	Savannah
WP-009	Barrow County	Potential water purchase from Barrow County	Barrow	Oconee
GW-001	Groundwater (Hall County)	Develop additional groundwater wells in Hall County to augment surface water supply sources	Hall	N/A
AC-001	Conservation Scenario 2	Conservation measures including Metropolitan North Georgia Water Planning District (MNGWPD) and GA Water Stewardship Act requirements - 0.19% non-revenue water (NRW) reduction/year through 2025	Hall	Not Applicable
AC-002	Conservation Scenario 3	Additional Conservation Measures 0.25% NRW reduction/year through 2025	Hall	Not Applicable
RR-001	Increase wastewater return to Lake Lanier	Potential indirect reuse strategy, increased flows to Lake Lanier through increased wastewater discharges	Hall	Chattahoochee
RR-002	Wastewater return to new reservoir	Potential indirect reuse strategy, increased flows to a new proposed reservoir through increased wastewater discharges	Hall	Chattahoochee
RR-003	Wastewater return to Cedar Creek Reservoir	Potential indirect reuse strategy, increased flows to Cedar Creek Reservoir through increased wastewater discharges	Hall	Oconee
RR-004	Increase Urban Irrigation	Increased use of wastewater effluent for urban irrigation	Hall	Chattahoochee/Oconee
SA-001	Shoal Creek Reservoir	Construction of new reservoir site to generate yield for the receiving county (Dawson) in exchange for potential storage allocation from Lake Lanier. A proposed dam on Shoal Creek located approximately 600 feet from the confluence of Shoal Creek and Etowah River, 4 miles southwest of Dawsonville.	Dawson	Coosa
SA-002	Settingdown Creek Reservoir	Construction of new reservoir site to generate yield for the receiving county (Forsyth/Cherokee) in exchange for potential storage allocation from Lake Lanier	Forsyth/ Cherokee	Coosa
SA-003	Lake Lanier- a total of 30 mgd (AAD) Allocation[1]	Potential additional allocation of 12 mgd from Lake Lanier for Gainesville (in addition to the existing allocation of 18 mgd)	Hall	Chattahoochee

ID	Name	Location/General Description	County	Basin
SA-004	Lake Lanier- a total of 43 mgd (AAD) Allocation[1]	Potential additional allocation of 25 mgd from Lake Lanier for Gainesville (in addition to the existing allocation of 18 mgd)	Hall	Chattahoochee
SA-005	Lake Lanier- a total of 60 mgd (AAD) Allocation[1]	Potential additional allocation of 42 mgd from Lake Lanier for Gainesville (in addition to the existing allocation of 18 mgd)	Hall	Chattahoochee
Regional Sources (RS)				
RS-001	West Point Lake	Pumping from West Point Lake to Hall County	Multiple	Chattahoochee
RS-002	Lake Rabun	Pumping from Lake Rabun to Hall County	Multiple	Savannah
RS-003	Lake Burton	Pumping from Lake Burton to Hall County	Multiple	Savannah
RS-004	Lake Hartwell	Pumping from Lake Hartwell to Hall County	Multiple	Savannah
RS-005	Tennessee River	Pumping from Tennessee River to Hall County	Multiple	Tennessee
RS-006	Chattahoochee River	Pumping from the Chattahoochee River (direct pumping - no reservoir)	Hall	Chattahoochee
Expansion of Existing Reservoirs (ER)				
ER-001	Cedar Creek (current configuration)	Using Cedar Creek Reservoir for water supply, under current configuration and safe yield	Hall	Oconee
ER-002A	Raising Cedar Creek Reservoir to 1,000' (+10')	Raising the dam of Cedar Creek Reservoir to 1,000 to increase storage volume	Hall	Oconee
ER-002B	Raising Cedar Creek Reservoir to 1,010' (+20')	Raising the dam of Cedar Creek Reservoir to 1,010 to increase storage volume	Hall	Oconee
ER-002C	Raising Cedar Creek Reservoir to 1,030' (+40')	Raising the dam of Cedar Creek Reservoir to 1,030 to increase storage volume	Hall	Oconee
ER-003	Raising Lake Lanier Level	Raising normal pool elevation 2 feet (from 1,071 to 1,073 feet mean sea level (MSL))/ Allocation of flood storage to water supply	Hall	Chattahoochee
New Reservoirs (NR)				
NR-001	Glades Reservoir	A proposed pumped storage reservoir on Flat Creek in Hall County. The proposed dam is located approximately 4,330 feet from the confluence of Flat Creek and the Chattahoochee River, 4.1 miles southeast of Cleveland.	Hall	Chattahoochee
NR-002	Mossey Creek Reservoir	A proposed dam on Mossey Creek approximately 375 feet from the confluence of Mossey Creek and Chattahoochee River in Hall County, 5.8 miles northeast of Clermont and 5.5 miles northwest of Raoul.	Hall	Chattahoochee
NR-003	White Creek Reservoir	A proposed dam on White Creek located approximately 4,200 feet from the confluence of White Creek and Chattahoochee River in White County, 6 miles southwest of Demorest and 8 miles southeast of Cleveland.	White	Chattahoochee
NR-004	Soquee River Reservoir	A proposed dam on Soquee River located approximately 3,300 feet from the confluence of Soquee River and Chattahoochee River in Habersham County, 3.8 miles southwest of Demorest	Habersham	Chattahoochee
NR-005	Upper Mud Creek Reservoir	A proposed dam on Mud Creek located approximately 4.5 miles from the confluence of Mud Creek and Little Mud Creek in Habersham County, 3 miles northwest of Raoul.	Habersham	Chattahoochee
NR-006	Lower Mud Creek Reservoir	A proposed dam on Mud Creek located approximately 2,000 feet from the confluence of Mud Creek and Chattahoochee River in Hall County, 3 miles west of Raoul.	Hall	Chattahoochee

ID	Name	Location/General Description	County	Basin
NR-007	Hagan Creek Reservoir	A proposed dam on Hagan Creek located approximately 2,300 feet from the confluence of Hagan Creek and the Chattahoochee River in Hall County, 1.5 miles northwest of Lula	Hall	Chattahoochee
NR-008	Lathem Creek Reservoir	A proposed dam on Lathem Creek located approximately 1.8 miles from the confluence of Lathem Creek and Chestatee Bay (Lake Lanier), 7.5 miles northwest of Gainesville and 11.8 miles south of Dahlonega	Hall	Chattahoochee
NR-009	Yahoola Creek Reservoir	A proposed dam on Yahoola Creek located approximately 1,200 feet from the confluence of Yahoola Creek and Chestatee River in Lumpkin County, 1 mile southeast of Dahlonega	Lumpkin	Chattahoochee
NR-010	Long Branch Reservoir	A proposed dam on Long Branch located approximately 2.75 miles from the confluence of Long Branch Creek and Chestatee River in Lumpkin County, 2.75 miles southeast of Dahlonega	Lumpkin	Chattahoochee
NR-011	Taylor Creek (Dawson Forest Site)	A proposed dam on Taylor Creek located approximately 3,000 feet from the confluence of Taylor Creek and Chestatee Bay (Lake Lanier), 6 miles east of Silver City and 8.5 miles southeast of Dawsonville	Dawson	Chattahoochee
NR-012	Rest Haven Reservoir	A proposed dam on a tributary to Suwannee Creek in northern Gwinnett County just south of Gwinnett-Hall County border and north of Jones Road	Gwinnett	Chattahoochee
NR-013	Old Atlanta Road Reservoir	A proposed dam on Dick Creek in southern Forsyth County near the intersection of Old Atlanta Road and Dick Creek	Forsyth	Chattahoochee
NR-014	Upper Big Creek Reservoir	A proposed dam located on Cobb Creek approximately 1,950 feet northwest from the confluence of Cobb Creek and Bentley Creek, 4.3 miles west of Cumming in western Forsyth County	Forsyth	Chattahoochee
NR-015	North Oconee River Reservoir	A proposed dam located on the North Oconee River approximately 4.75 miles northwest from the confluence of North Oconee River and Candler Creek, 11.2 miles northwest of Commerce and 11 miles southeast of Gainesville	Jackson	Oconee
NR-016	Tallulah River Reservoir	A potential dam location on Black Branch near the confluence with the Tallulah River, located just west of the Georgia-South Carolina State Line	Habersham/ Rabun	Savannah
NR-017	Calhoun Creek Reservoir	A proposed dam on Calhoun Creek located approximately 3,500 feet from the confluence of Calhoun Creek and Etowah River in Lumpkin County, 3 miles east of Dawsonville	Lumpkin	Coosa
Potential Quarry Storage (QS)				
QS-001	Gainesville Quarry	Using the existing rock quarry located at 2955 Candler Road, Gainesville, GA 30507 as a water supply reservoir	Hall	Oconee
QS-002	Ramsey Road Quarry	Using the existing rock quarry located at 2996 Ramsey Road, Gainesville, GA 30507 as a water supply reservoir	Hall	Oconee
QS-003	Friendship Quarry	Using the existing rock quarry located at 4195 Friendship Road, Buford, GA 30519 as a water supply reservoir	Hall	Oconee
QS-004	Dahlonega Quarry	Using the existing rock quarry located at 983 Red Oak Flats Road, Dahlonega, GA 30533 as a water supply reservoir	Lumpkin	Chattahoochee
Transmission (TM)				

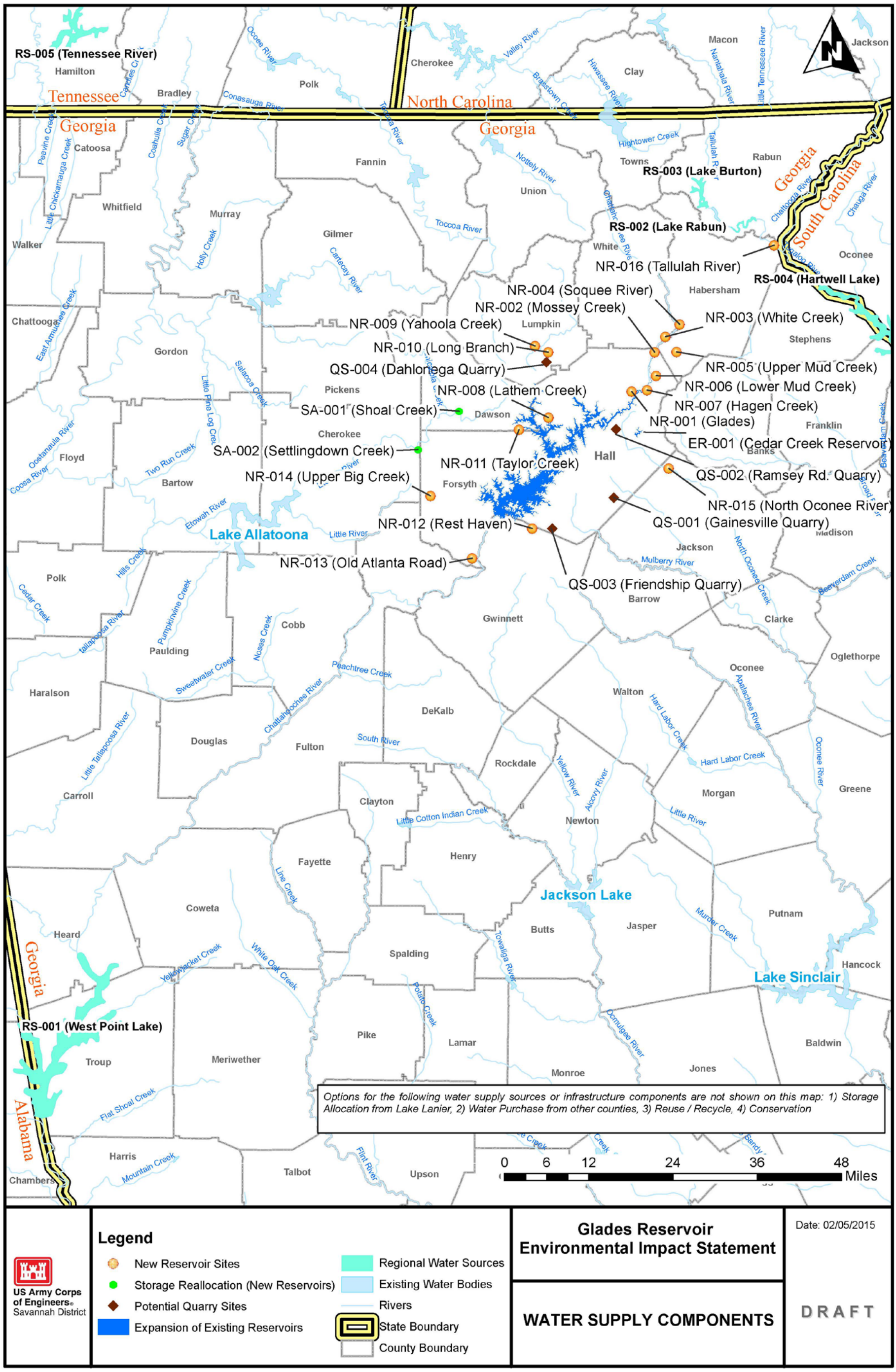
ID	Name	Location/General Description	County	Basin
TM-001	Release to Lake Lanier and withdraw from Lakeside Water Treatment Plant (WTP)	Applicant's proposed transmission alternative is to release the stored water to Lake Lanier and withdraw from Lakeside or Riverside WTP	Hall	Chattahoochee
TM-002	Pump to WTP for treatment	Pump water from the new reservoir to an existing WTP (Lakeside) for treatment	Hall	Chattahoochee
TM-003	Construct new WTP at new reservoir site	Construct a new WTP on the site of a new reservoir.	Various	Chattahoochee

AAD: Annual average day

Note:

1. Basis of additional Lake Lanier allocation quantity is discussion in section 2.4.4.

Figure 2.3 Location of Water Supply Components



2.3.1 Phase 1A - Screening of Components for Feasibility

A set of exclusionary criteria was used to eliminate those components not capable of meeting the basic project purpose and need, or that have fatal flaws due to existing technology, logistics, and environmental consequences. **Table 2.3** summarizes these practicability criteria developed based on 40CFR230 Subpart B. The Corps developed these criteria with input from the cooperating agencies.

During Phase 1A screening, individual components were evaluated for feasibility and not for their sufficiency to meet the entire project need; it was anticipated that multiple components would ultimately be combined to formulate project alternatives that meet entire project need. Thus, a component was not eliminated automatically for failure to meet 100% of Hall County's stated unmet 2060 demands.

2.3.1.1 Results of Phase 1A Screening

After Phase 1A screening was completed, a total of 31 components were eliminated, leaving 25 to be carried forward to the Phase 1B Screening. **Table 2.4** and **Figure 2.4** show the water supply components remaining after the Phase 1A screening. The eliminated components and the assumptions that led to their elimination are discussed in **Appendix K**. In summary, as a result of Phase 1A screening:

- 13 components were eliminated because they did not result in additional water supply to Hall County by supplementing existing sources and practices (Criteria PN1).
- 1 component was eliminated because it did not produce additional supply prior to need exceeding the existing supply (estimated by 2025) (Criteria PN2).
- 8 components were eliminated because water sources were not located with the State of Georgia and within Hall County or adjacent counties (Criteria L2).
- 4 components were eliminated because they were not within the authorization of the Corps and the State of Georgia to approve/permit (Criteria L4).
- 5 components – new reservoir sites - were eliminated because they were not capable of storing approximately 1.17 billion gallons (BG) of water, only providing a partial solution to meeting project need (Criteria L5).
- 1 component was eliminated because it is not physically and legally available to Hall County from a sustainable source in sufficient amounts and with sufficient frequency to satisfy the need for additional firm yield in a practicable manner. (Criteria L6)
- 8 components were eliminated because they were not from the two river basins that are located within Hall County (Chattahoochee and Oconee) (Criteria L7)
- 6 components were eliminated for more than one criteria (L2 and L7, L2 and L4, or PN2, L4, and L6)

Table 2.3 Phase 1A Screening Criteria for Water Supply Components

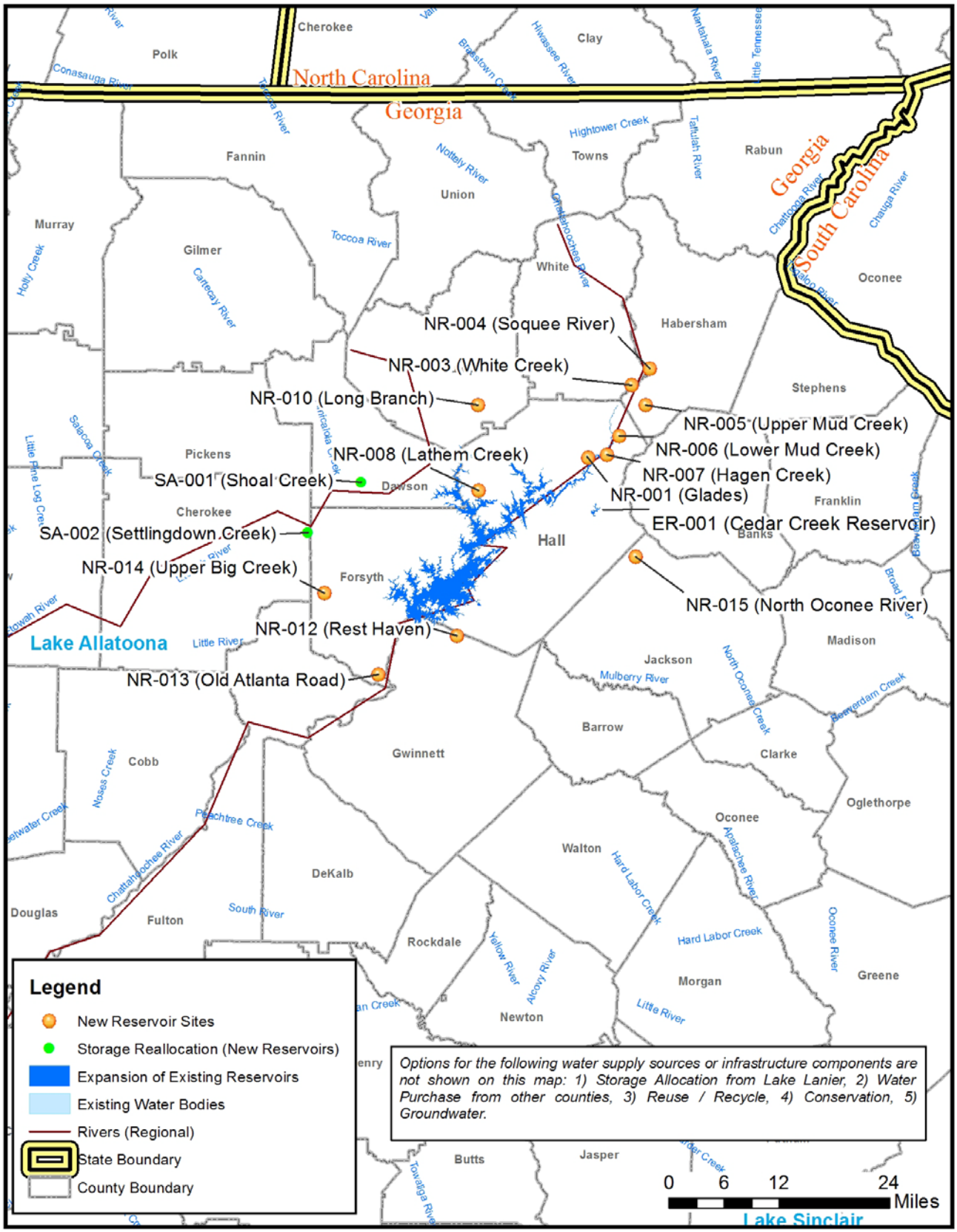
Criteria	Basis for Screening
Purpose and Need (PN)	
PN1*	Must result in additional water supply to Hall County beyond existing sources and practices. Must achieve a contribution (safe yield > 0) toward meeting the project purpose and need, which could be achieved through a number of different sources such as demand management (conservation, leak reduction and etc.), reuse, groundwater, or a potential reservoir.
PN2	Must produce additional supply prior to need exceeding the existing supply (estimated by 2025)
Logistics (L) - Including Geographic consideration, institutional issues and practicability	
L1	Must not require extreme or extraordinary technical effort or significantly complex or costly means to overcome difficult access, site conditions, utility conflicts, or constructability issues. Difficult site conditions are defined as physical conditions resulting in high risk or unusual engineering solutions such as high risk soils, potential landslides, fault lines, hazardous drainage from mines or mine tailing, or abandoned mine tunnels.
L2	Must be (1) within Georgia and (2) within Hall County or adjacent counties to avoid the significant logistical, permitting, and schedule challenges.
L3	Must be located (1) outside lands or sites known to be integral to infrastructure development plans or (2) outside areas having existing or planned incompatible land use. Must avoid the conflicts and costs associated with displacing critical existing or reasonably foreseeable planned infrastructural developments (examples: airport or Interstate Highway), especially if development may not be compatible with water supply functions. Must not lie within areas that clearly create a significant challenge to practicable and affordable development - such as national and state parks, designated wild and scenic or wilderness areas, Superfund sites, landfills and hazardous waste landfills. Development of water supply features in these areas would either be forbidden by statute or regulations, or very difficult to accomplish.
L4	Must be within the ability of the Corps and the State of Georgia to approve or permit. Must not require unprecedented permitting or logistic challenges that would jeopardize completion in a timeframe consistent with the identified long-term need of Hall County. In particular, must not (1) affect federal facilities or property that would require Congressional authorization, (2) impound Section 10 navigable waterway, or (3) require adoption of new federal policies.
L5	A new reservoir site must be able to store approximately 10% of Glades' estimated usable water supply volume (1.17 BG), providing a partial solution to meeting Project Need; reservoir sites with volumes less than 1.17 BG will likely require higher (than Applicant's proposed) pumping quantity from the Chattahoochee or Oconee Rivers to generate sufficient firm yield to contribute to the project purpose and need.
L6	A water supply must be physically and legally available to Hall County from a sustainable source in sufficient amounts and with sufficient frequency to satisfy the need for additional firm yield in a practicable manner.
L7	Water Supply Sources must be compatible with MNGWPD rules and policies" including 1) no interbasin transfer, 2) minimize consumptive use
Environmental Consequences (EC)	
EC1	Must not have any known unmitigable environmental issues, including any known environmental or permitting fatal flaws such as destruction of protected species designated critical habitat, construction on federal lands, or water quality violations.

Table 2.4 Water Supply Components Remaining after Phase 1A Screening

Water Purchase (WP)	
WP-005	Purchase from Jackson County
Develop Additional Groundwater (GW)	
GW-001	Groundwater (Hall County)
Additional Conservation (AC)	
AC-001	Conservation Scenario 2
AC-002	Conservation Scenario 3
Lake Lanier Additional Storage Allocation / Exchange of Storage (SA)	
SA-001	Shoal Creek Reservoir
SA-002	Settingdown Creek Reservoir
SA-003	Lake Lanier- 30 mgd Total Allocation (12 mgd additional allocation)[1]
SA-004	Lake Lanier- 43 mgd Total Allocation (25 mgd additional allocation) [1]
SA-005	Lake Lanier- 60 mgd Total Allocation (42 mgd additional allocation) [1]
Expansion of Existing Reservoirs (ER)	
ER-001	Cedar Creek Reservoir (current configuration)
New Reservoir (NR)	
NR-001	Glades Reservoir
NR-003	White Creek Reservoir
NR-004	Soquee River Reservoir
NR-005	Upper Mud Creek Reservoir
NR-006	Lower Mud Creek Reservoir
NR-007	Hagan Creek Reservoir
NR-008	Lathem Creek Reservoir
NR-010	Long Branch Reservoir
NR-012	Rest Haven Reservoir
NR-013	Old Atlanta Road Reservoir
NR-014	Upper Big Creek Reservoir
NR-015	North Oconee River Reservoir
Transmission (TM)	
TM-001	Release to Lake Lanier (and withdraw from Lakeside WTP)
TM-002	Pipe to WTP for treatment
TM-003	Construct new WTP at New Reservoir Site

[1] Basis of additional Lake Lanier allocation quantity is discussed in Section 2.4.4.

Figure 2.4 Water Supply Components Remaining After Phase 1A Screening



2.3.2 Phase 1B – Preliminary Environmental Screening

Phase 1B involved a preliminary environmental screening of the 14 new reservoir sites that passed the 1A screening. Construction of new reservoirs is anticipated to have higher impacts to aquatic resources than other water supply components that do not involve significant new construction, such as water purchase, additional conservation, or additional Lake Lanier storage allocation. The goal of this screening was to narrow the range of new reservoirs to those with impacts that are similar to or less than the Applicant's Proposed Project. Phase 1B screening focused on a desktop analysis of potential impacts to aquatic resources and other impacts for the 14 new reservoir sites (see **Table 2.4** - 12 from the NR category and 2 from SA category). Transmission components associated with a new reservoir sites were not included in the Phase 1B screening, as impacts from transmission main construction will be temporary in nature and will be avoided wherever possible in final design whereas reservoir impacts would be permanent and unavoidable in nature. The transmission components were developed and evaluated further during the Phase 2 screening, after the list of potential reservoir sites was refined.

The approach to evaluation of aquatic impacts used in this EIS was based on the Corps Savannah District's document, *Guidelines for Preparation of Analysis of Section 404 Permit Applications Pursuant to the Section 404(b)(1) Guidelines of the Clean Water Act (40 CFR, Section 230)*, in particular, Part II, which addresses the application of 40 CFR 230.10(a) and 404(b)(1) criteria to the alternative analysis process.

Creation of a reservoir will require construction of a dam, spillway, potential saddle dams, access road(s), flow-control structures, pump stations, and other facilities that will necessitate fill and/or disturbance of the existing habitat. Operation of a reservoir will result in inundation within the footprint of the reservoir, converting all habitats to lentic, or lake, habitat. The shoreline of the reservoir will be subject to clearing of vegetation, control of nuisance vegetation, removal of debris, erosion control, and periodic drawdown of the reservoir.

Using ArcGIS software, a polygon for each reservoir was defined to encompass the reservoir footprint at the top of dam elevation. To conduct a fair comparison between components, a common data source was used for each impact analysis using publicly available data sources (such as National Hydrography Dataset (NHD), National Wetlands Inventory (NWI), etc.). Although more detailed information has been developed related to potential impacts for the Applicant's proposed site (a formal Corps Jurisdictional Determination), this information was not used during the Phase 1B screening so that a fair comparison can be carried out entirely based on publicly accessible information that was available for all sites.

Phase 1B screening is based on the comparison of the following environmental factors, as described in the Corps guidelines:

- Wetlands and Streams
- Federal and State Protected Species
- Cultural Resources
- Other Factors

The basis of comparison for each factor is described below.

2.3.2.1 Wetlands and Streams

The NWI was used to determine potential wetlands impacts from construction of water supply components. The NWI maps were used to determine wetland acreages that would either be inundated by water or filled due to constructing and operating the reservoir. The NWI database was established by the U.S. Fish and Wildlife Service (USFWS) to provide information on the distribution and type of wetlands and other waters based on photointerpretation of aerial photographs. NWI databases are classified according to *Classification of wetlands and deepwater habitats of the United States* (Cowardin et al., 1979).

The screening analysis based on the NWI database is intended to provide a fair comparison between the potential reservoir sites, not to determine final wetland impacts. The NWI database may return slightly different results than a traditional field survey (as required by the 1987 Corps Wetland Delineation Manual). However, any discrepancies between the NWI database and field survey would be generally similar at every potential construction site.

A reservoir site would fail the Phase 1B screening for wetlands if the estimated potential impacts were greater than or equal to 53 acres, 40% greater than the Applicant's preferred site (Glades).

Intermittent and Perennial Streams

The NHD, maintained by the U.S. Geological Survey (USGS), is a GIS record of features such as lakes, ponds, streams, rivers, canals, dams, and stream gauges. It is the digital equivalent of the blue lines (water) shown on USGS topographic maps. Similar to the wetland analysis, the NHD may return different results than a field survey; however, any discrepancies would be unlikely to bias the comparison.

A reservoir site would fail the Phase 1B screening for streams if the estimated potential impacts were greater than or equal to 12 miles, 40% greater than the Applicant's preferred site (Glades).

2.3.2.2 Federal and State Protected Species

The Georgia Department of Natural Resources (GDNR) Wildlife Resources Division (WRD) maintains a database of rare species potentially present by quarter quadrangle throughout the State of Georgia. In addition, the WRD maintains a similar database organized by 10-digit Hydrologic Unit Code (HUC-10) watersheds. To identify whether a federal or state protected species has the potential to occur within each reservoir site, these databases were queried for all quarter quadrangles and HUC-10 watersheds in which each reservoir site occurred.

A reservoir site would fail the Phase 1B screening for Federal and State Protected Species if the site potentially impacts five or more state protected species or any federal species. The Applicant's preferred site was mapped to one potential state protected species and no federal species at the time of the initial evaluation (prior to the listing of Northern Long-Ear Bat).

2.3.2.3 Cultural Resources

The potential for cultural resources to be present on each site was assessed based on national and state databases. The National Register of Historic Places (NRHP), maintained by the National Park Service (NPS), is the official list of the nation's historic places worthy of preservation. Georgia Natural, Archaeological, and Historic Resources Geographic Information System (GNAHRGIS) is a state-maintained database cataloging archaeological

and historic resources of Georgia. GNAHRGIS is maintained by the GDNR Historic Preservation Division (HPD). In this context, archaeological resources means archaeological sites recorded in the Georgia Archaeological Site File and historic resources include buildings, structures, historic sites, landscapes, and districts in the HPD's Historic Resources Survey or listed in the NRHP.

These databases were queried to identify sites included in either database that occurred within the reservoir project footprint. A reservoir site would fail the Phase 1B screening for cultural resources if any NRHP sites were identified within the footprint or three or more GNAHRGIS sites were identified. None of these resources were mapped to the Applicant's preferred sites.

2.3.2.4 Other Factors

The Corps guidelines also allow for "Other Factors" to be incorporated into the 404(b)(1) analysis. Because of the sensitivity surrounding displacement of residential and commercial properties and the expense involved in replacing or rerouting roads, these factors were also incorporated into Phase 1B:

- Displacements – Residential
- Displacements – Commercial
- Displacements – Roads

Recent aerial photographs were examined to identify the number of residences, commercial structures, and roads that could be impacted by any of the water supply components. The Phase 1 B does not include characterization of the structures (size, type, or value) potentially affected.

A reservoir site would fail the Phase 1B screening if greater than 12 residential structures, 12 commercial buildings, or 12 roads displacements were identified. Three residential, two commercial, and one road displacement was identified at the Applicant's preferred site.

2.3.2.5 Results of Phase 1B Screening

A summary of the data collected for Phase 1B Screening for new reservoir sites is included in **Table 2.5**. A total of 10 components (10 new reservoir sites) were eliminated during Phase 1B screening, based on impacts that were assessed to be measurably greater than the Applicants preferred site. The impacts were assessed based on the best available information at the time of screening (see text box **Alternatives Analysis Status Update - How new Information is incorporated)**. **Appendix K** summarizes the eliminated components and the assumptions/reasons for elimination. The four reservoir sites that passed the Phase 1B screening will be carried forward into Phase 2 for the formulation of water supply alternatives.

Table 2.5 Phase 1B Screening Summary for New Reservoir Sites[1, 2]

ID	Name	Wetlands (acre)	Stream (miles)	State R/T/E Species (#)	Federal Protected Species[2] (#)	NRHP Cultural Resource Sites (#)	GNAHRGIS Cultural Resource Sites (#)	Displacement			Impacts Clearly Greater than Applicant - Proposed Project?
								Residential (#)	Commercial (#)	Roads (#)	
NR-001	Glades Reservoir	37.7	9.9	1	0	0	0	3	2	1	
NR-003	White Creek Reservoir	37.6	8.4	1	0	0	1	10	1	7	
NR-004	Soquee River Reservoir	67.0	18.6	1	0	0	5		2	3	Yes - FAIL
NR-005	Upper Mud Creek Reservoir	26.7	9.6	1	0	0	0	10	7	11	
NR-006	Lower Mud Creek Reservoir	47.6	11.3	4	0	0	0	6	0	4	
NR-007	Hagan Creek Reservoir		8.0	3	0	0	0	0	1	2	Yes - FAIL
NR-008	Lathem Creek Reservoir	0.6	4.1	3	0	0	0		0	2	Yes - FAIL
NR-010	Long Branch Reservoir	0.0	6.9	4	0	0	0		0	3	Yes - FAIL
NR-012	Rest Haven Reservoir	16.4	1.7	2	0	0	0	0		1	Yes - FAIL
NR-013	Old Atlanta Road Reservoir	3.7	2.4	0	0	0	2		1	3	Yes - FAIL
NR-014	Upper Big Creek Reservoir	7.7	6.1	1	1	0	0		0	4	Yes - FAIL
NR-015	North Oconee River Reservoir			3	0	0	2			10	Yes - FAIL
SA-001	Shoal Creek Reservoir	2.0	0.1			0	0	0	0	1	Yes - FAIL
SA-002	Settingdown Creek Reservoir	19.0	3.6			0	0		1	1	Yes - FAIL

Notes:

1. Pink shading represents the criteria where the estimated impacts were clearly larger than the Applicant's Proposed Project and therefore eliminated for further consideration. Green shading represents new reservoir sites that pass Phase 1B screening.

2. Additional federally protected species were listed after the time of the original Phase 1B Analysis. These species include: Black Spored quillwort, Indiana Bat, Northern Long Eared Bat, Persistent trillium, Small Whorled pogonia, and Smooth coneflower. As no water supply components were eliminated solely for protected species impacts, this analysis was not updated. However, the new species were included in the detailed evaluation of water supply alternatives (see Chapter 2.5.3.

Alternatives Analysis Status Update (How new Information is incorporated)

The alternatives analysis is an iterative process that integrates engineering, design, agency consultation, stakeholder feedback, and additional technical information that may come to light as the project develops. For this DEIS, the screening criteria and process was developed with the input from the cooperating agencies in 2012 and 2013 (prior to the screening of the individual components and formulating alternatives). This section presents the initial infrastructure component screening results based on the process and criteria developed. These analyses are based on the best available data at the time of development, but are subject to change as the DEIS evolves over multiple years.

As of August 2015, the following input has been received: new protected species are listed for multiple counties evaluated in the alternatives analysis section. The initial protected species data included in the Phase 1B screening (completed in 2013) did not result in the elimination of any water supply components (Table 2.5). These components that passed the initial Phase 1B screening were used to formulate alternatives for Phase 2 evaluation.

Updated protected species data were included in the Phase 2 alternatives analysis as one of multiple environmental criteria used to compare alternatives, as well as for the alternatives carried forward for detailed evaluation in Chapter 4.

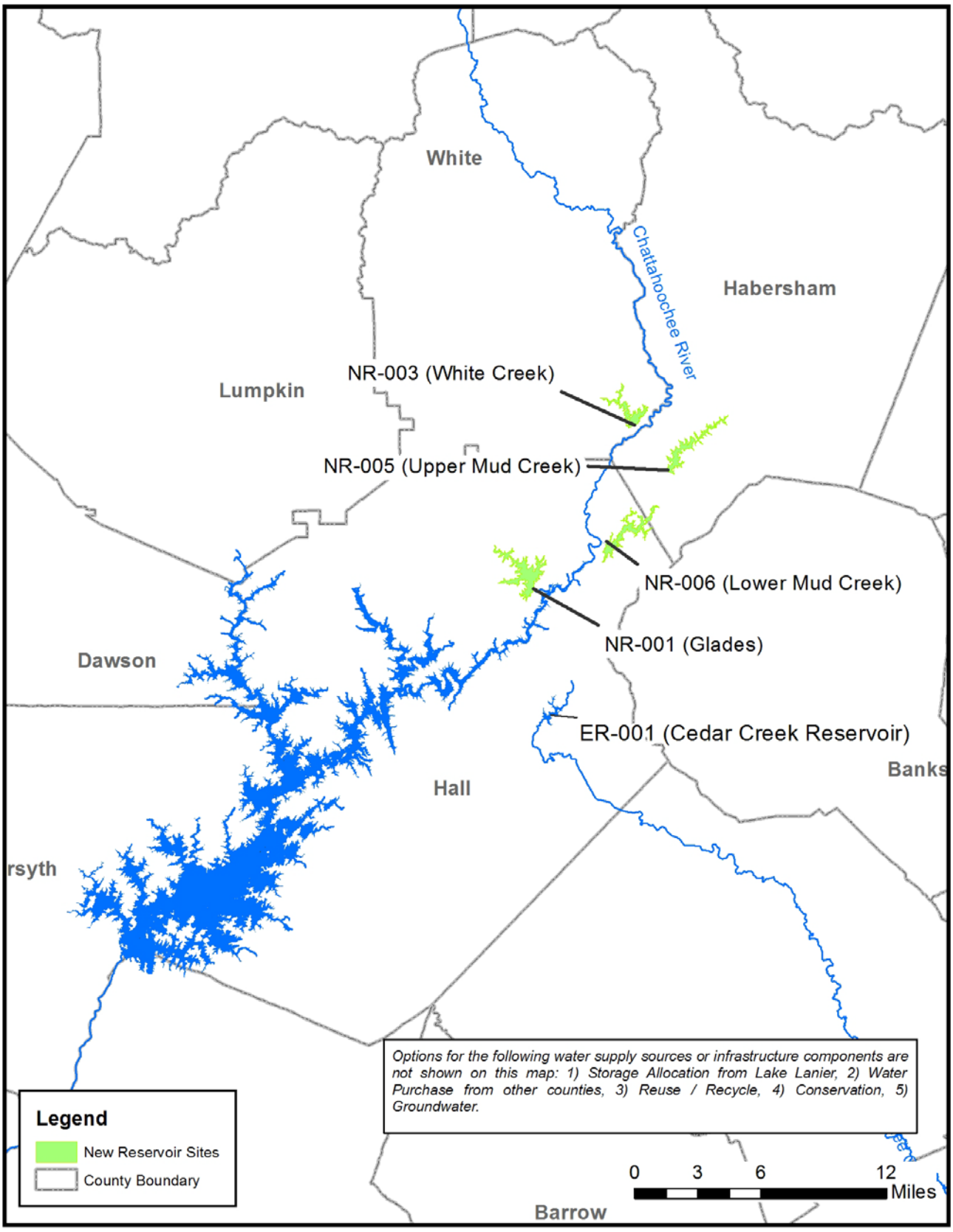
2.4 Final Screened Components

Upon the completion of Phase 1, a total of 15 water supply components were carried forward in Phase 2 and used in the formulation of water supply alternatives. **Table 2.6** and **Figure 2.5** show these final screened components, and each component is described further in subsections below.

Table 2.6 Phase 1 Final Screened Water Supply Components

ID	Name
Water Purchase (WP)	
WP-005	Purchase from Jackson County
Develop Additional Groundwater (GW)	
GW-001	Groundwater (Hall County)
Additional Conservation (AC)	
AC-001	Conservation Scenario 2
AC-002	Conservation Scenario 3
Lake Lanier Additional Storage Allocation / Exchange of Storage (SA)	
SA-003	Lake Lanier- 30 mgd Total Allocation (12 mgd additional allocation)
SA-004	Lake Lanier- 43 mgd Total Allocation (25 mgd additional allocation)
SA-005	Lake Lanier- 60 mgd Total Allocation (42 mgd additional allocation)
Expansion of Existing Reservoirs (ER)	
ER-001	Cedar Creek Reservoir (current configuration – no expansion)
New Reservoir (NR)	
NR-001	Glades Reservoir
NR-003	White Creek Reservoir
NR-005	Upper Mud Creek Reservoir
NR-006	Lower Mud Creek Reservoir
Transmission (TM)	
TM-001	Release to Lake Lanier and withdraw from Lakeside WTP
TM-002	Pump to Lakeside WTP for treatment
TM-003	Construct a new WTP at New Reservoir Site

Figure 2.5 Phase 1 Final Screened Water Supply Components



2.4.1 Water Purchase from Jackson County

Water purchase options were reviewed in the Water Purchase Technical Memorandum (**Appendix H**). The only potential water purchase that was considered viable was water purchase from Jackson County (WP-005). All other counties adjacent to Hall County are not projected to have excess water supply available for purchase for the planning horizon. Based on this analysis, Jackson County would have an available 1.2 mgd (annual average) of finished water potentially available for purchase through 2060.

To purchase finished water from Jackson County, interconnection between Jackson County and Hall County distribution systems are required. The Hall County distribution system currently already extends into Jackson County in several places, therefore infrastructure may be in place to support this interconnection, depending on the extent and service condition of Jackson County's water system.

2.4.2 Groundwater

A review of groundwater availability (Groundwater Availability Technical Memorandum, **Appendix F**) concluded that 3.4 mgd is currently permitted (baseline availability), and limited additional groundwater supplies could be developed. Approximately 4.7 mgd of total groundwater supplies could be potentially available in Hall County in 2060. This additional level of groundwater availability (1.3 mgd) is considered a water supply component during alternative formulation.

2.4.3 Additional Conservation

Several conservation scenarios were evaluated for this EIS, as described in Chapter 1, Section 1.6.5. Of the three modeled scenarios, Scenario 1 is the "baseline" water demand which represents the existing demand-side and supply-side management efforts that could be achieved through continued implementation of the International Plumbing Code of 2006 (State of Georgia's minimum requirements) and existing conservation programs and education efforts. This "baseline" scenario assumes that the existing level of non-revenue water (NRW), estimated at approximately 15.9% of total water withdrawal, will be maintained through 2060. Scenario 1 is eliminated for further consideration.Two additional future scenarios with more aggressive conservation programs are described below.

2.4.3.1 Conservation Scenario 2 (AC-001)

Scenario 2 represents water demand with the implementation of existing and required future levels of conservation. This scenario uses the baseline water demand and estimates of additional conservation levels that could be achieved through continued implementation of the International Plumbing Code of 2006, the MNGWPD conservation requirements, and the Georgia Water Stewardship Act requirements. This scenario assumes that NRW will be reduced to 12.95% by 2025 and steady from 2025-2060.

2.4.3.2 Conservation Scenario 3 (AC-002)

Scenario 3 represents a more aggressive conservation scenario. This scenario includes the conservation programs modeled in Scenario 2 and assumes a higher NRW reduction goal – the NRW will be reduced to 12.09% by 2025, and will maintain steady at this level through 2060 with continued implementation of maintenance programs (leak reduction/repair and meter replacement).

2.4.4 Lake Lanier Additional Storage Allocation

In addition to the existing withdrawal scenario of 18 mgd (AAD) based on current withdrawal level from Gainesville, three additional scenarios passed the screening. Lake Lanier allocation is an important factor in the formulation of alternatives because the greater the allocation provided, the less supply that will be needed from alternative sources. The Lake Lanier allocation quantity will ultimately be determined within the Corps ACF Basin WCM Update DEIS. The below scenarios represent potential total water supply allocations from Lake Lanier.

2.4.4.1 Total Allocation of 30 mgd from Lake Lanier (SA-003)

The 30 mgd AAD total withdrawal scenario requires an additional 12 mgd allocation for Gainesville (in addition to the current 18 mgd withdrawal level). This AAD quantity is converted based on the permitted maximum monthly withdrawal limit of 35 mgd for Gainesville by Georgia EPD. EPD issues surface water withdrawal permits based on maximum monthly and maximum daily withdrawal limits. Typically both of these limits are identified in a withdrawal permit.

2.4.4.2 Total Allocation of 43 mgd from Lake Lanier (SA-004)

Based on **Appendix B** of the MNGWPD's 2009 Water Supply and Water Conservation Management Plan, it anticipates that Gainesville/Hall County's current permitted withdrawal from Lake Lanier will be increased to a maximum monthly average of 53 mgd (or 71 mgd peak day) by 2035. Using a maximum month to AAD factor of 1.23, the equivalent AAD withdrawal is approximately 43 mgd (25 mgd additional allocation).

2.4.4.3 Total Allocation of 60 mgd from Lake Lanier (SA-005)

This scenario assumes that Hall County's future water supply needs will be met by Lake Lanier without construction of a new surface water supply source. Additional allocation to allow withdrawal up to 60 mgd AAD (42 mgd additional allocation) from Lake Lanier would be required to meet the 2060 demand.

2.4.5 Cedar Creek Reservoir

Cedar Creek Reservoir, an existing reservoir owned by Hall County and currently maintained by the City of Gainesville through an Intergovernmental Agreement between Hall County and Gainesville (see Chapter 1 for descriptions of the agreement), will be a common component for all water supply alternatives. The available water supply from this reservoir has not been needed to date. The permit to withdraw water from Cedar Creek Reservoir was issued in 2002 by Georgia EPD and the permitted safe yield of 7.3 mgd was estimated based on the 1986-1989 drought at the time the reservoir and the withdrawal was permitted. A permit to withdrawal from the North Oconee River also was issued to allow the Cedar Creek Reservoir to operate as a pumped-storage reservoir.

2.4.6 New Reservoir Sites

Four potential new reservoir sites passed the Phase 1A and 1B Screenings and will be considered as potential water supply components for alternatives analysis. These sites are summarized in **Table 2.7**.

Table 2.7 New Reservoir Sites – Reservoir Characteristics Summary

ID	Site	County	Drainage Area (sq mi)	Normal Pool (acre)	Surface Area Flood Pool (acre)	Dam Height (feet)	Potential Usable Volume [1] (acre-feet)	(BG)	Safe Yield[2, 3] without Pumping (mgd)
NR-001	Glades (Flat Creek)[3]	Hall	17.6	850	1002	140	28,908	9.4	12.4
NR-003	White Creek	White	10.2	479	656	145	10,422	3.4	5.6
NR-005	Upper Mud Creek	Habersham	12.2	413	561	60	6,518	2.1	5.5
NR-006	Lower Mud Creek	Hall	38.9	498	660	93	13,849	4.5	15.0

[1]Potential useable volume is calculated from the normal pool storage volume, with the assumption that 20% of the volume is inactive due to sediment storage

[2]All safe yield calculations assume that the water supply volume is withdrawn at the reservoir and a minimum release below the dam is maintained to meet the instream flow protection threshold (IFPT) to be approved by EPD.

[3]The safe yield for Glades Reservoir is estimated based on the assumption that the water supply quantity will be pumped to a WTP for treatment and a IFPT of 3 mgd will be released downstream of the dam. If the water supply quantity is released below the dam via Flat Creek to Lake Lanier, no additional release is needed to meet the IFPT requirement. This results in a 3-mgd increase of safe yield.

Hall County (the Applicant) defined the safe yield as:

> *"[T]he reliable withdrawal rate of water with acceptable quality that can be provided by a combination of streamflows and reservoir storage through a defined critical drought period. Safe yield is dependent upon the storage and hydrologic (rainfall/runoff/evaporation) characteristics of the source, the source facilities, the selected critical drought, upstream and downstream permitted withdrawals, and minimum instream flow (MIF) requirements." (Safe Yield Analysis, 404 permit application)*

Safe yield is defined as the maximum dependable **annual average quantity** that can be available for water supply during a critical drought period. To meet the range of potential water supply needs, the reservoir could be operated as a pumped-storage reservoir with water pumped from the Chattahoochee River. A range of pumping rates was considered to establish the range of safe yield possible at each site. The EIS team has coordinated extensively with the Georgia EPD on the development of the instream flow protection threshold (IFPT) used for reservoir safe yield analysis (**Appendix O**)**.** IFPT is needed for the protection of the aquatic environment and users downstream of the water withdrawal location and is part of the permit conditions evaluated by the Georgia EPD when considering a water withdrawal permit application. Details of the safe yield analysis are documented in a Technical Memorandum (**Appendix M**)**.** The following is a brief summary of the assumptions for the safe yield analysis:

- Reservoir yield is estimated for both without pumping (natural drainage only) and with pumping (pumped-storage reservoirs) from the Chattahoochee River.
- Various pumping scenarios were analyzed to determine the **maximum safe yield**, defined as the highest reservoir yield possible when an increase in daily pumping rate no longer increases the reservoir yield. An "**effective pumping range**" also is established for the range where an increase in daily pumping rate results in a steady increase in reservoir yield (the maximum effective pumping rate can be found when the increase in yield becomes relatively small despite increased pumping). The **range of effective reservoir yield** in this EIS at each site is determined based on the range of effective pumping rate from the yield analysis. **Table 2.8** summarizes the effective range of reservoir yield based on the effective

range of pumping established for each of the screened reservoir site. Additional discussions and a figure illustrating the relationship between the reservoir yield and daily pumping rate for each site are provided in the following sub-sections.

- An IFPT or the natural streamflow, whichever is lower, will be maintained at all times below the respective pump station location at Chattahoochee River for Glades and White Creek Reservoirs. Details on the IFPT analysis are provided in **Appendix O**.
- The IFPT analysis for the Chattahoochee River intake was based on observed flow from USGS gage 02331600 Chattahoochee River near Cornelia, GA for the period of 1/1/1958 through 12/31/2012 per EPD's recommendation. The AADF is estimated to be 922 cfs for the period of 1/1/1958 through 12/31/2012 at the Chattahoochee River pump station location for the Glades Reservoir (a drainage area ratio was applied). The streamflow records from the Chattahoochee from 1939 to 2012 were used for the safe yield analysis. This includes simulated flows from 1939 to 1957 and observed streamflow records from 1958 to 2012.
- Pumping is allowed only when the IFPT conditions below the raw water intake at the Chattahoochee River can be met.
- Various transmission scenarios were analyzed for how water is delivered to the WTP. In the PT transmission scenario, the water supply quantity is released from the reservoir via the tributary to "pass-through" Lake Lanier for treatment at the Lakeside WTP. In PL transmission scenario, water is pumped directly from the reservoir to Lakeside WTP for treatment. For WTP scenario, water is pumped from the reservoir to a new WTP to be constructed adjacent to the reservoir. When the water supply quantity is released via the tributary, the IFPT below the dam is automatically met. For PL/WTP scenarios, additional flows must be released below the dam to the tributary to meet the IFPT requirement.
- An IFPT or the natural streamflow, whichever is lower, will be maintained below the dam at all times.
- The IFPT analysis for the streamflow below the dam was based on the available observed flow for the period of 1/1/1984 through 12/31/2012 from a nearby USGS gage 02334885 Suwanee Creek at Suwanee, GA (a drainage area ratio was applied). The streamflow records from the Suwanee gage from 1939 to 2012 were used for the safe yield analysis. This includes simulated flows from 1939 to 1983 and observed streamflow records from 1984 to 2012.

Table 2.8 Range of Estimated Reservoir Yield and Effective Pumping Rate for Pumped-Storage Reservoir Operation at Reservoir Sites Passed Phase 1 Screening[1, 2, 3]

Potential New Reservoir Site	Maximum Reservoir Safe Yield (mgd, AAD)	Range of Effective Reservoir Yield[1] (mgd, AAD)	Range of Effective Daily Pumping (mgd, MD)
Glades Reservoir (Flat Creek) PT	99.7	15.1 to 86	0 (no pumping) to 100
Glades Reservoir (Flat Creek) PL	97.0	12.4 to 83	0 (no pumping) to 100
Glades Reservoir (Flat Creek) WTP	97.0	12.4 to 83	0 (no pumping) to 100
White Creek PT	34.4	7.6 to 30	0 (no pumping) to 50
White Creek PL	33.3	6.1 to 30	0 (no pumping) to 60
Upper Mud Creek PT	25.0	5.5 to 20	0 (no pumping to 40
Lower Mud Creek PT	60.0	15.0 to 55	0 (no pumping) to 60

Notes:

The maximum safe yield, defined as the highest reservoir yield possible when an increase in daily pumping rate no longer increases the reservoir yield. An "effective pumping range" is established for each site when an increase in daily pumping rate no longer results in a steady increase in reservoir yield. The range of effective reservoir yield is established based on the range of effective pumping rate in this EIS.

[1] Reservoir yield is based on annual average quantity.

[2] Pumping rate is based on maximum daily pumping quantity.

[3] PT=flow pass-through Lake Lanier, PL=flow pumped to Lakeside WTP, WTP=flow treated at a new WTP adjacent to the reservoir.

2.4.6.1 Glades Reservoir (NR-001)

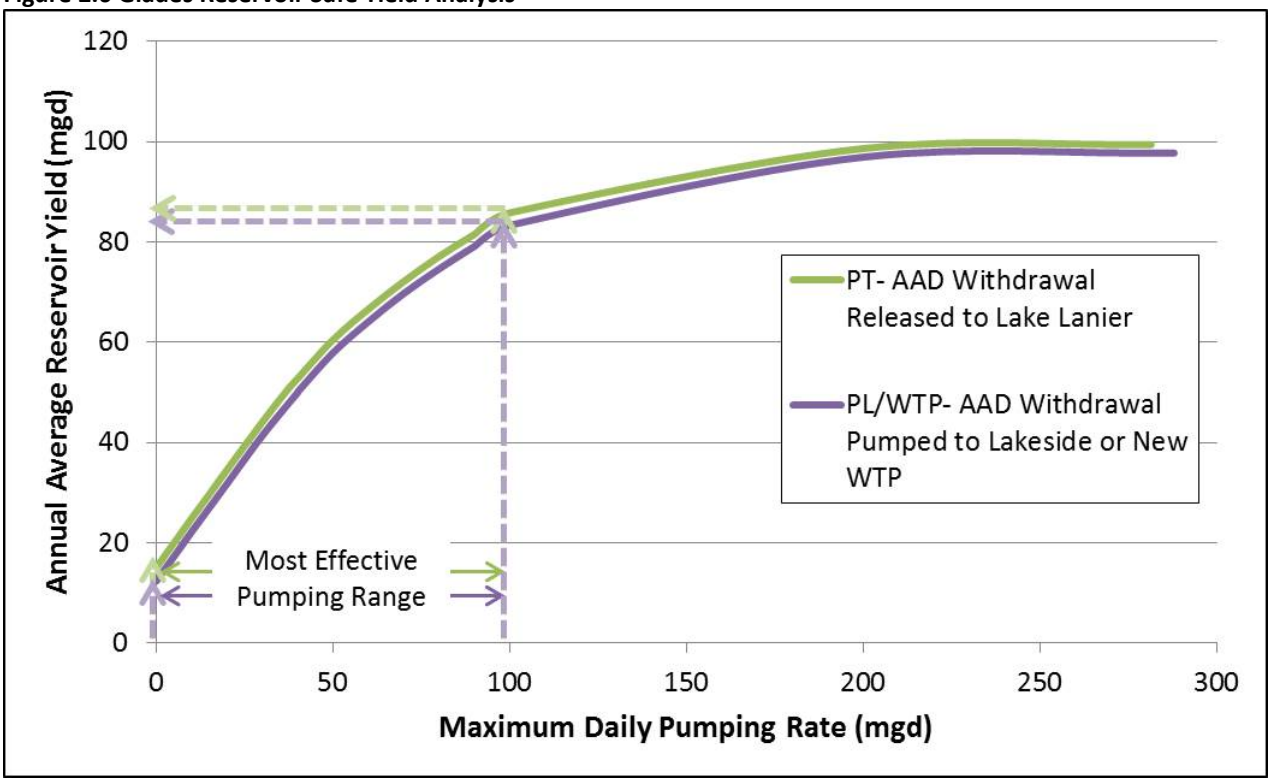
Glades Reservoir is the Applicant's Proposed Project for meeting 2060 water supply needs. The proposed dam is located on Flat Creek approximately 4,300 feet from the confluence of Flat Creek and Chattahoochee River. The proposed dam would impound approximately 850 acres at a normal pool water surface elevation of 1180 feet MSL. The proposed reservoir would be located in Hall County, approximately 4 miles southeast of Cleveland. Glades Reservoir would be operated as a pumped-storage reservoir storing water pumped from the Chattahoochee River. **Table 2.9** summarizes the characteristics of the proposed Glades Reservoir**. Figure 2.6** shows the results of the safe yield analysis conducted to determine potential water supply availability under a range of pumping rates and various transmission scenarios. The proposed reservoir site is shown in **Figure 2.7.**

Table 2.9 Glades Reservoir Characteristics

Top of Dam (Flood Pool) Elevation	1,190	Feet
Water Surface Area at Flood Pool	1,002	Acres
Water Surface Elevation at Normal Pool	1,180	Feet
Water Surface Area at Normal Pool	850	Acres
Total Storage Volume at Normal Pool	36,136	Acre-Feet
Total Usable Volume[1] at Normal Pool	28,908	Acre-Feet
Total Usable Volume at Normal Pool	9.4	BG
Dam Height	140	Feet
Dam Length	1400	Feet

[1] It is assumed that 20% of the total volume is reserved for sediment storage

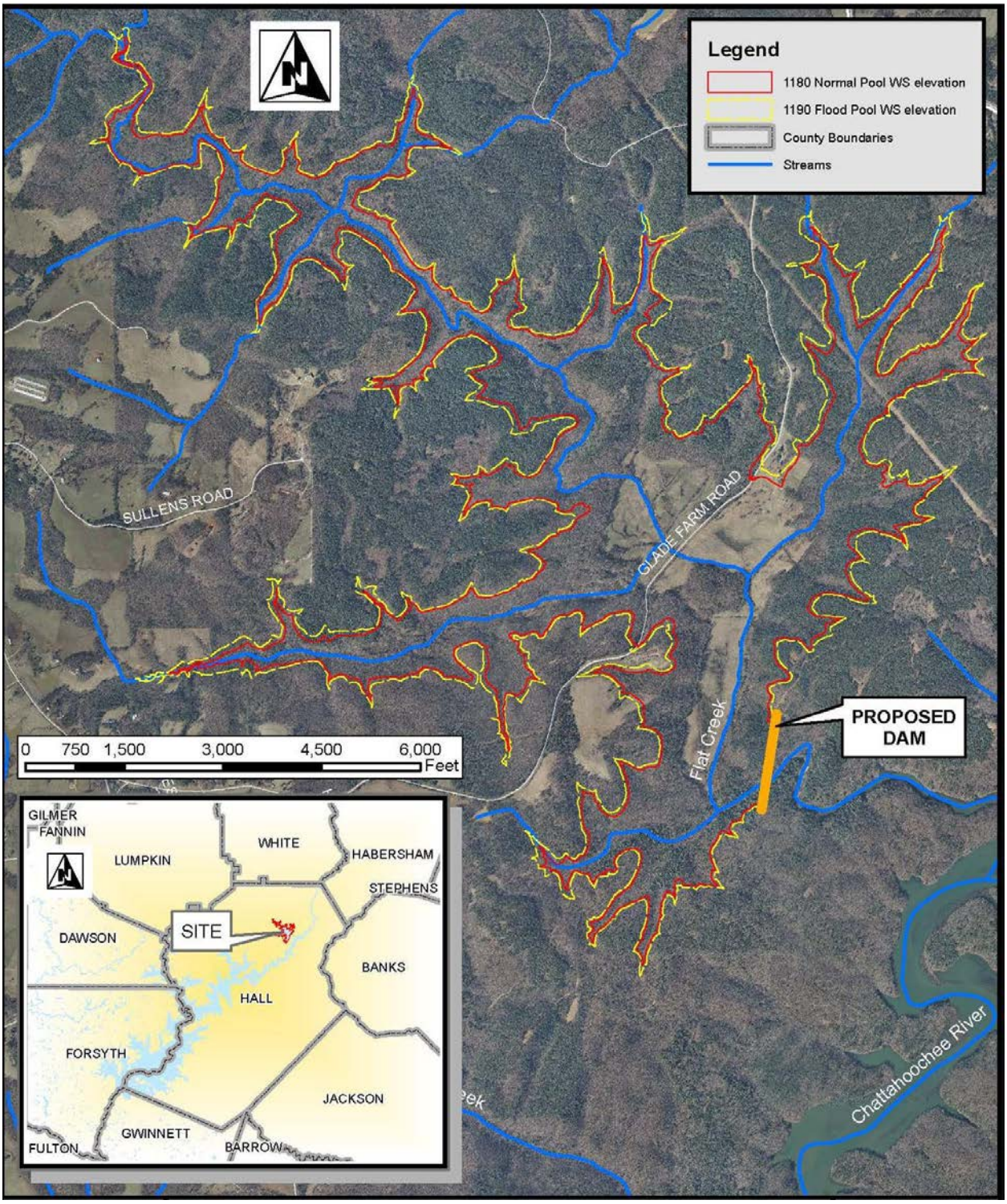
Figure 2.6 Glades Reservoir Safe Yield Analysis[1,2]



[1] The 2-Stage IFPT is maintained below the Chattahoochee River intake. The 2-Stage IFPT is equal to the A7Q10 (99.5 mgd) from June through January, and 30% of the AADF (178.8 mgd) from February through May.

[2] The A7Q10 IFPT (3.0 mgd) is maintained below the dam.

Figure 2.7 Proposed Glades Reservoir Site



2.4.6.2 White Creek Reservoir (NR-003)

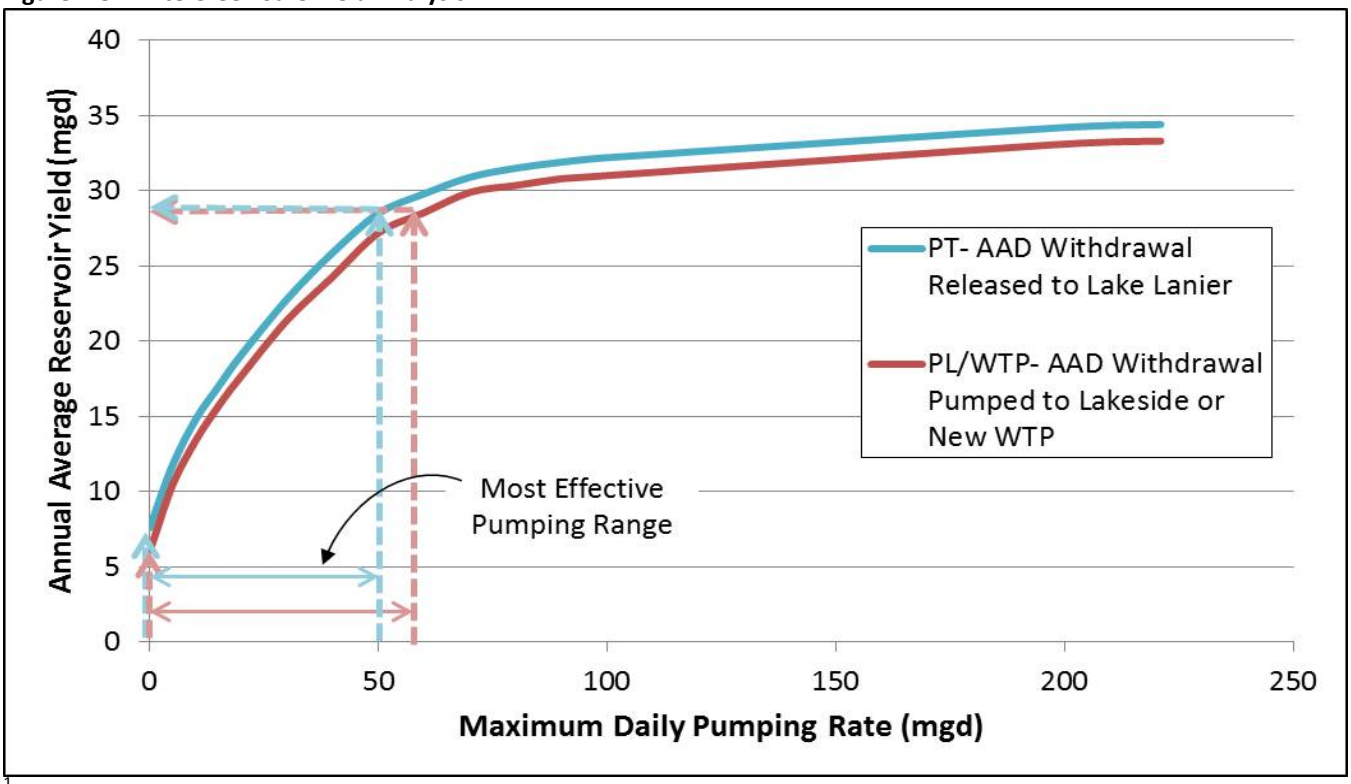
The White Creek Reservoir is a potential alternative water supply source for meeting 2060 water supply needs. The proposed dam is located on White Creek approximately 4,700 feet from the confluence of White Creek and Chattahoochee River. The proposed dam would impound approximately 480 acres at a normal pool water surface elevation of 1305 feet MSL. The proposed reservoir would be located in White County, approximately 6 miles southwest of Demorest and 8 miles southeast of Cleveland. White Creek Reservoir, similar to the proposed Glades Reservoir, would be operated as a pumped-storage reservoir storing water pumped from the Chattahoochee River. **Table 2.10** summarizes the characteristics of the White Creek Reservoir**.** Results from the safe yield analysis are shown in **Figure 2.8.** The proposed reservoir site is shown in **Figure 2.9.**

Table 2.10 White Creek Reservoir Characteristics

Top of Dam (Flood Pool) Elevation	1,315	Feet
Water Surface Area at Flood Pool	656	Acres
Water Surface Elevation at Normal Pool	1,305	Feet
Water Surface Area at Normal Pool	479	Acres
Total Storage Volume at Normal Pool	13,014	Acre-Feet
Total Usable Volume[1] at Normal Pool	10,422	Acre-Feet
Total Usable Volume at Normal Pool	3.4	BG
Dam Height	145	Feet
Dam Length	2,670	Feet

[1] Potential useable volume is calculated from the Normal Pool Volume, with the assumption the 20% of the volume is inactive due to sediment storage

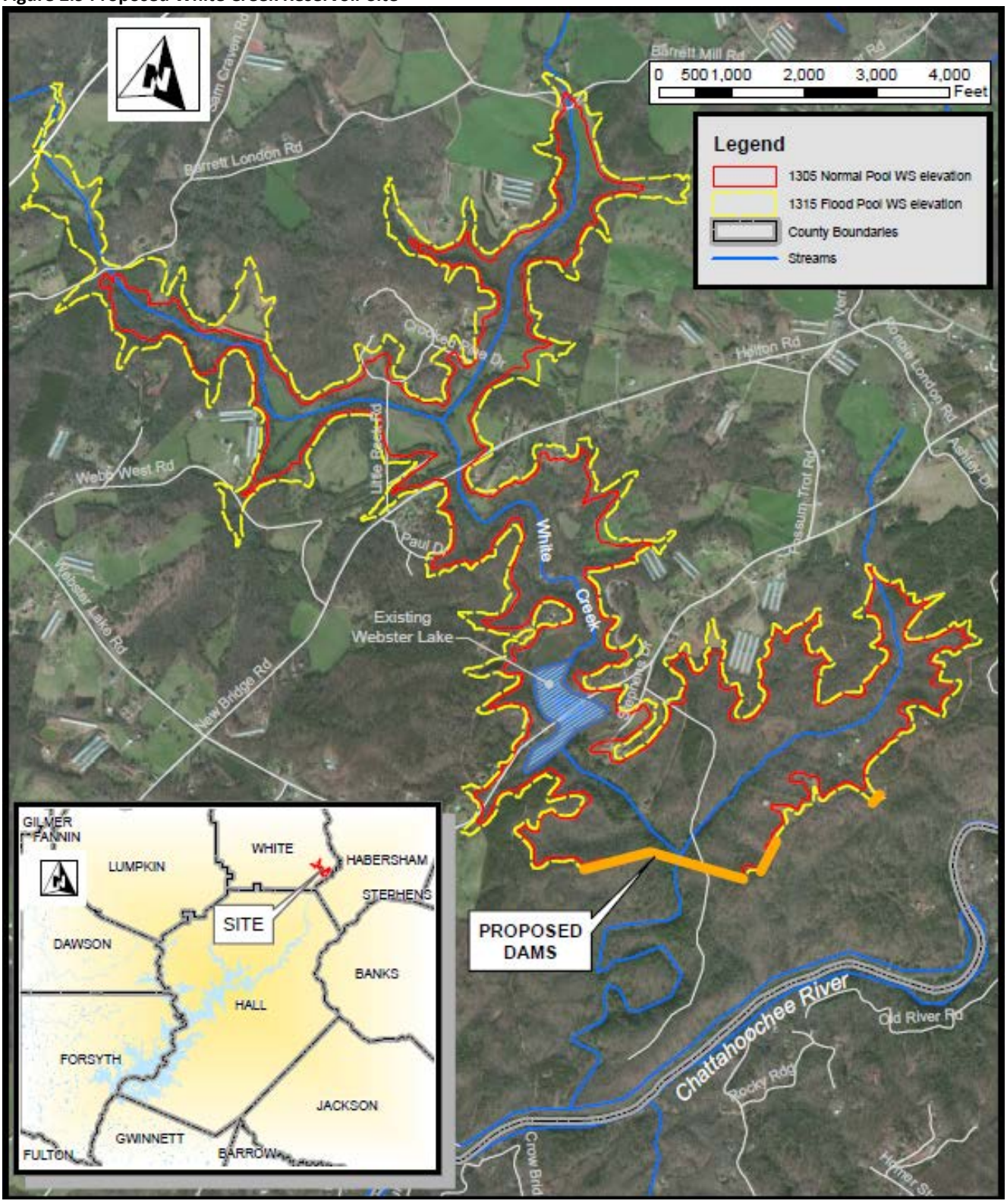
Figure 2.8 White Creek Safe Yield Analysis[1,2]



[1] The M7Q10 IFPT is maintained below the Chattahoochee River intake.

[2] The M7Q10 IFPT is maintained below the dam.

Figure 2.9 Proposed White Creek Reservoir Site



2.4.6.3 Upper Mud Creek (NR-005)

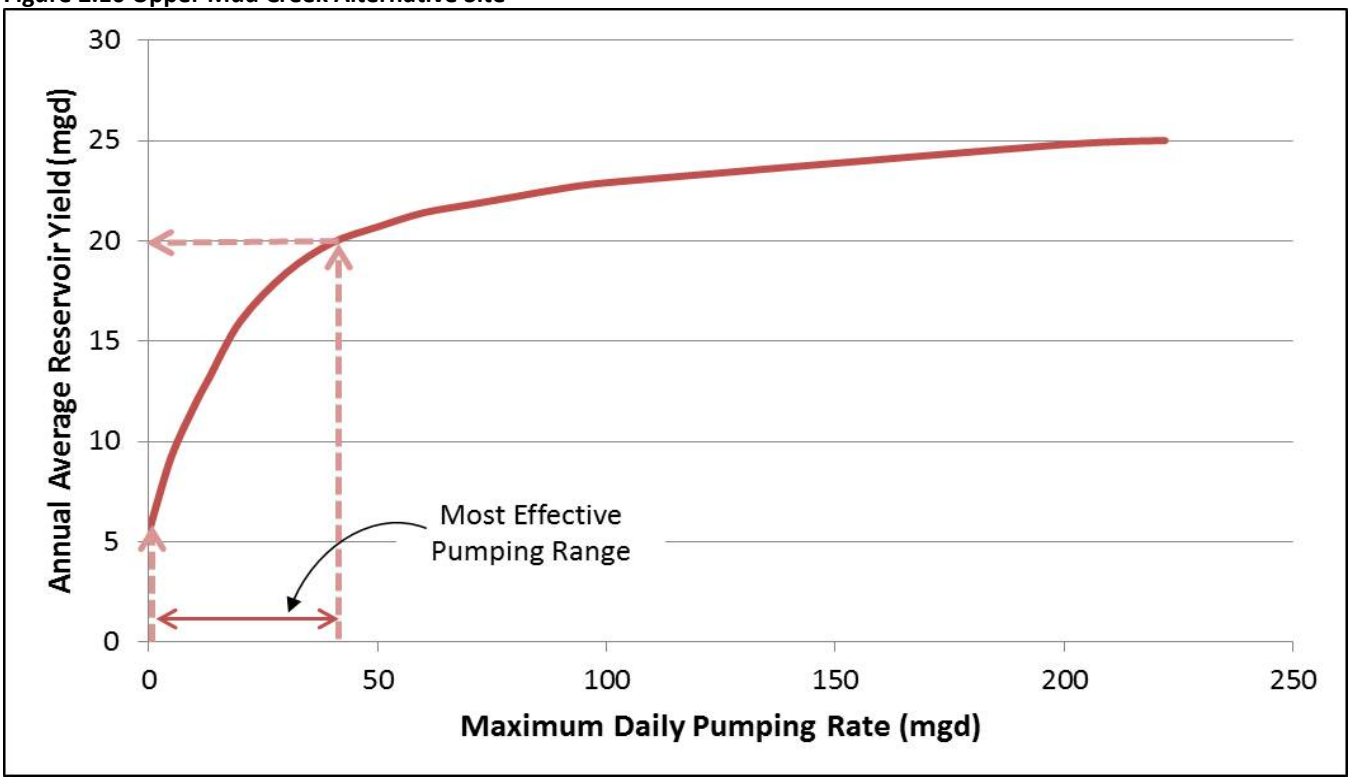
The Upper Mud Creek Reservoir site has been identified as a potential alternative water supply source for meeting 2060 water supply needs. The proposed dam is located on Mud Creek approximately eight miles from the confluence of Mud Creek and Chattahoochee River. The proposed dam would impound around 413 acres at a normal pool water surface elevation of 1290 feet MSL. The proposed reservoir would be located in Habersham County, approximately three miles northwest of Raoul. Similar to the proposed Glades Reservoir, the Upper Mud Creek Reservoir would be operated as a pumped-storage reservoir storing water pumped from the Chattahoochee River. **Table 2.11** summarizes the characteristics of the Upper Mud Creek Reservoir**.** Results from the safe yield analysis are shown **Figure 2.10.** The proposed reservoir site is shown in **Figure 2.11.**

Table 2.11 Upper Mud Creek Reservoir Characteristics

Top of Dam (Flood Pool) Elevation	1,300	Feet
Water Surface Area at Flood Pool	561	Acres
Water Surface Elevation at Normal Pool	1,290	Feet
Water Surface Area at Normal Pool	413	Acres
Total Storage Volume at Normal Pool	8,150	Acre-Feet
Total Usable Volume[1] at Normal Pool	6,518	Acre-Feet
Total Usable Volume at Normal Pool	2.1	BG
Dam Height	60	Feet
Dam Length	935	Feet

[1] Potential useable volume is calculated from the Normal Pool Volume, with the assumption the 20% of the volume is inactive due to sediment storage

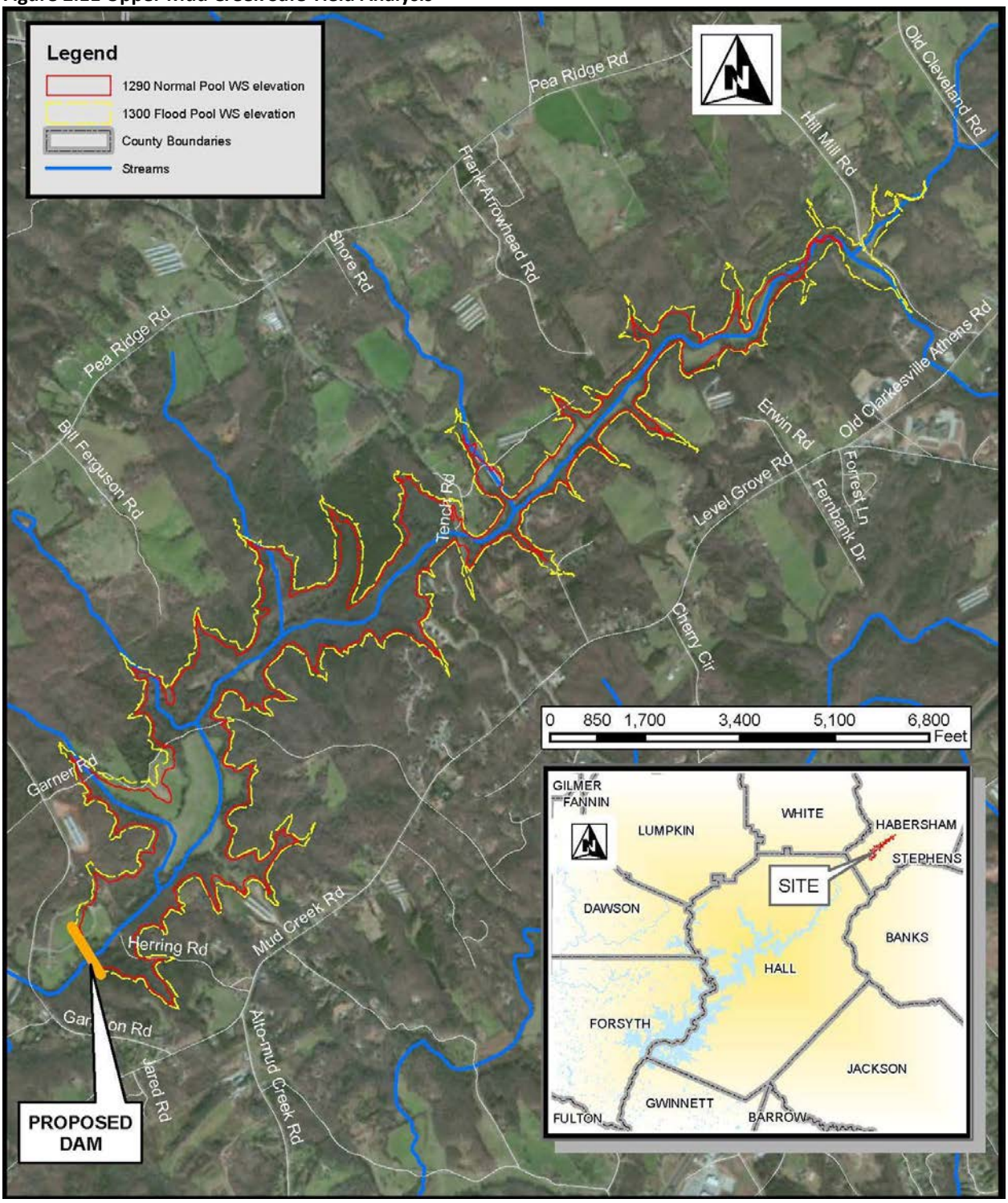
Figure 2.10 Upper Mud Creek Alternative Site[1,2]



[1] The M7Q10 IFPT is maintained below the Chattahoochee River intake.

[2] The A7Q10 IFPT (2.1 mgd) is maintained below the dam.

Figure 2.11 Upper Mud Creek Safe Yield Analysis



2.4.6.4 Lower Mud Creek (NR-006)

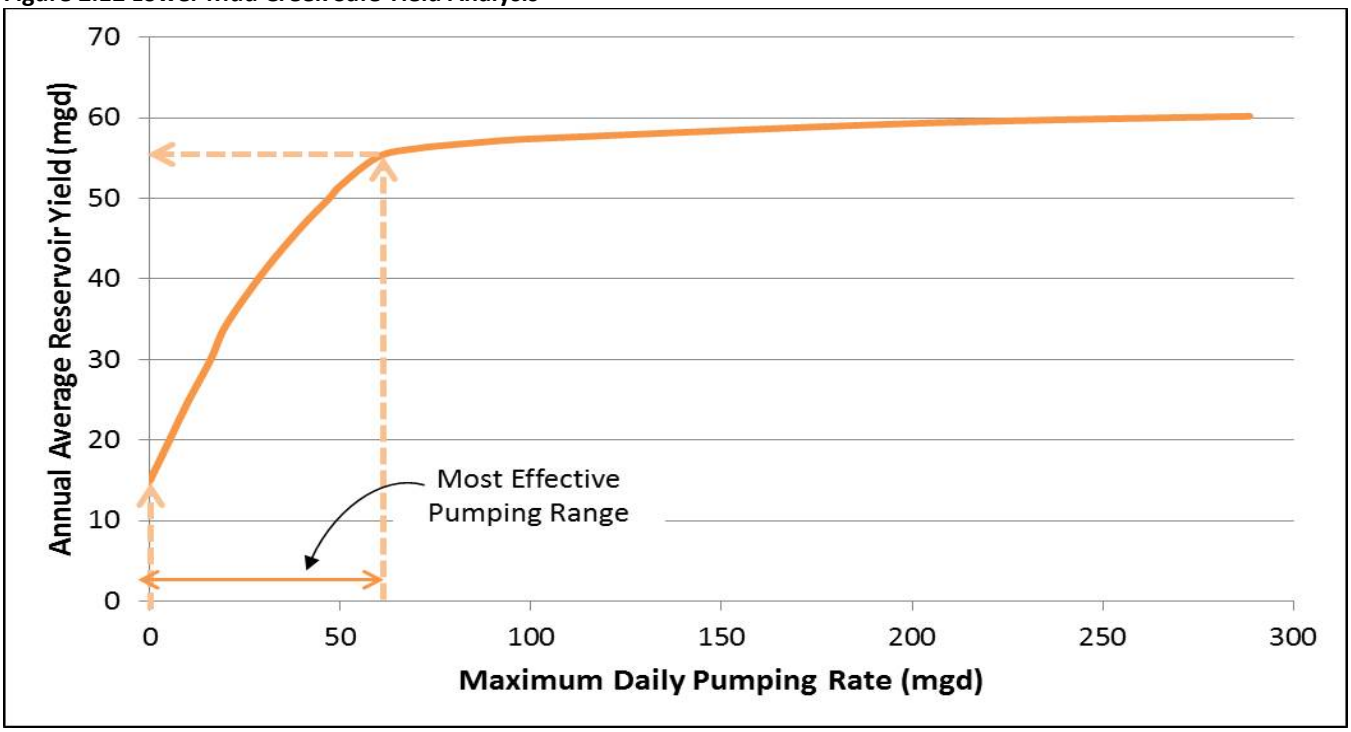
The Lower Mud Creek Reservoir site has been identified as an alternative water supply source for meeting 2060 water supply needs. The proposed dam is located on Mud Creek approximately 2,000 feet from the confluence of Mud Creek and Chattahoochee River. The proposed dam would impound approximately 498 acres at a normal pool water surface elevation of 1155 feet MSL. The proposed reservoir would span the border of Hall and Habersham counties, and would be located approximately 3 miles west of Raoul. Similar to the proposed Glades Reservoir, the Lower Mud Creek Reservoir would be operated as a pumped-storage reservoir storing water pumped from the Chattahoochee River. **Table 2.12** summarizes the characteristics of the Lower Mud Creek Reservoir**.** Results from the safe yield analysis are shown in **Figure 2.12.** The proposed reservoir site is shown in **Figure 2.13.**

Table 2.12 Lower Mud Creek Reservoir Characteristics

Top of Dam (Flood Pool) Elevation	1,165	Feet
Water Surface Area at Flood Pool	660	Acres
Water Surface Elevation at Normal Pool	1,155	Feet
Water Surface Area at Normal Pool	498	Acres
Total Storage Volume at Normal Pool	17,312	Acre-Feet
Total Usable Volume[1] at Normal Pool	13,849	Acre-Feet
Total Usable Volume at Normal Pool	4.5	BG
Dam Height	93	Feet
Dam Length	930	Feet

[1] Potential useable volume is calculated from the Normal Pool Volume, with the assumption the 20% of the volume is inactive due to sediment storage

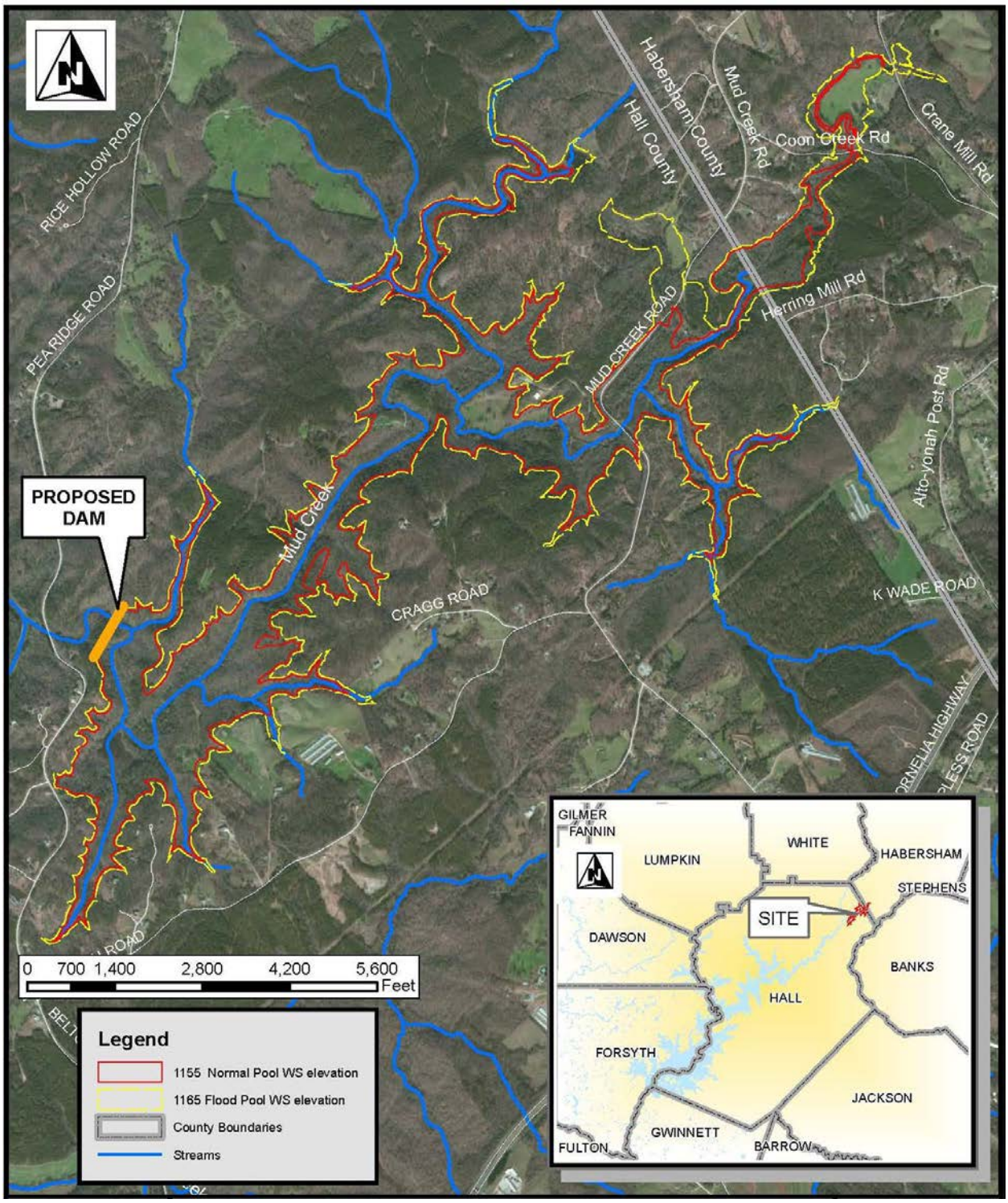
Figure 2.12 Lower Mud Creek Safe Yield Analysis[1,2]



[1] The 2-Stage IFPT is maintained below the Chattahoochee River intake. The 2-Stage IFPT is equal to the A7Q10 (99.5 mgd) from June through January, and 30% of the AADF (178.8 mgd) from February through May.

[2] The A7Q10 IFPT (6.6 mgd) is maintained below the dam.

Figure 2.13 Lower Mud Creek Alternative Site



2.4.7 Transmission

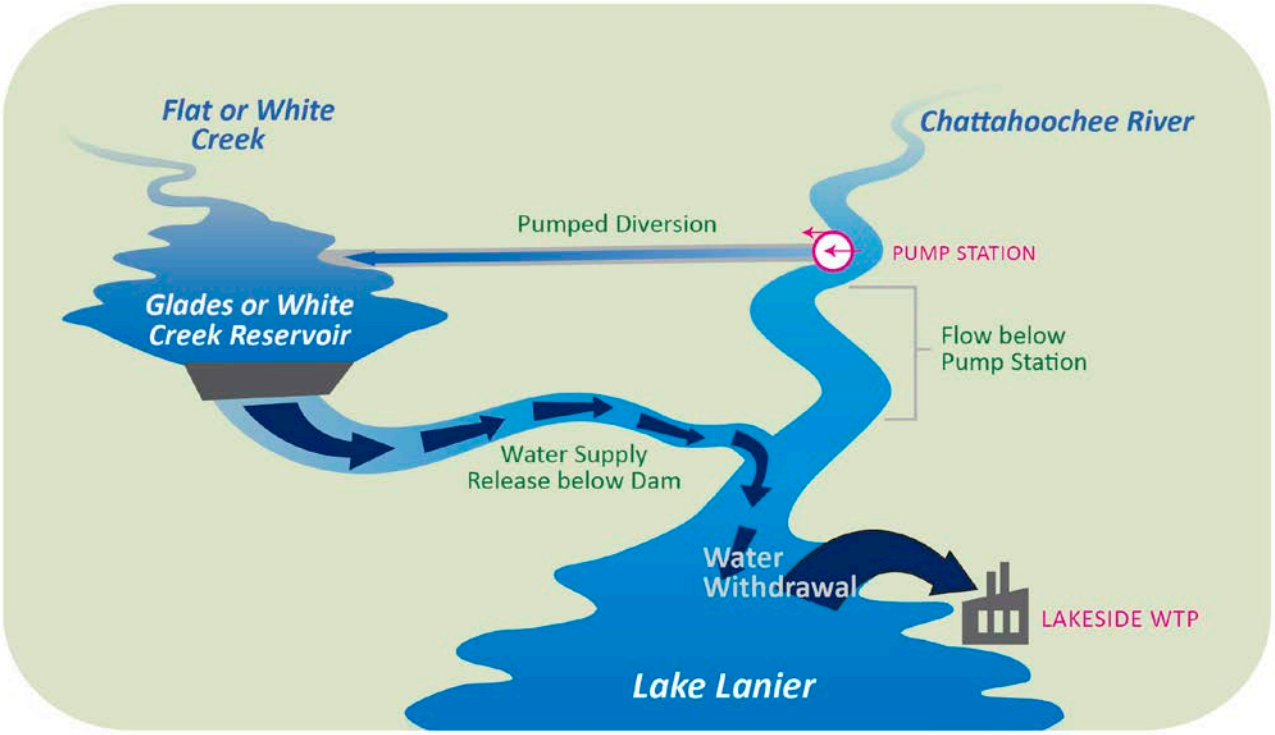
The transmission components are options for providing a conveyance mechanism to transfer water from a new water supply reservoir to the water treatment and distribution system.

2.4.7.1 Release to Lake Lanier (TM-001)

This transmission option, also referred to as "pass-through" assumes that water supply from the proposed reservoir will be released downstream of the dam and will flow through Lake Lanier via the creek (tributary to Chattahoochee River upstream of Lake Lanier). The water supplied from the proposed reservoir will be withdrawn from Lake Lanier at the existing intake for Gainesville's Lakeside WTP, see **Figure 2.14**. Gainesville Lakeside WTP was designed to allow for future expansion up to 100 mgd (the older Riverside WTP is limited to its current capacity). As Gainesville and Hall County's demand increase, future expansion of Lakeside WTP will be required. However the plant expansions are not included in the analysis, as it will be required for all alternatives analyzed.

This is Hall County's preferred operation for the Glades Reservoir. Current Corps policy, however, does not allow for "pass thorough" without a storage contract as is intended by this component. The Applicant could opt to release water from Glades, pass it through Lanier, and withdraw at Lakeside WTP; but under current Corps policy, the Applicant would still need a water storage contract for the volume of water passed through. The Corps Headquarter is evaluating this policy currently but it is not known when and how this policy may be changed. However, as the Glades Reservoir may not be needed for a period of time (depending on the ultimate Lake Lanier allocation Gainesville/Hall County will receive), this transmission option is retained for evaluation.

Figure 2.14 Pass-through Transmission Scenario

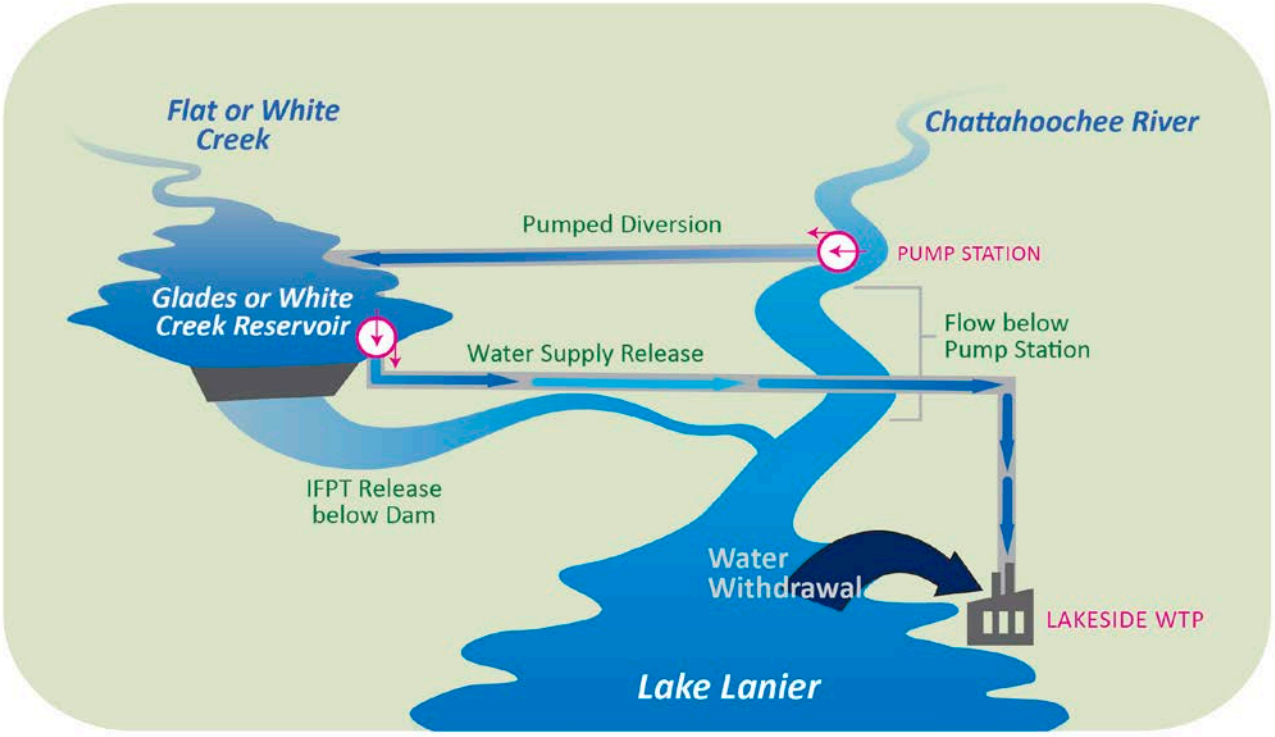


2.4.7.2 Direct Pumping to an Existing WTP (TM-002)

Instead of "passing through" Lake Lanier, this component assumes that water from the proposed reservoir will be pumped directly to a WTP for treatment. This transmission option was developed because the Corps' current policy does not allow the "pass-through" scenario to occur without a storage contract. Although the Corps headquarter is evaluating the "pass-through" policy, it is unknown when this policy may be changed and how it may be changed. Therefore, two additional transmission options have been developed for evaluation. The direct pumping transmission option includes a new raw water pump station at the proposed reservoir and a new raw water transmission main from the proposed reservoir to the existing Lakeside WTP, see **Figure 2.15** Future expansion of Lakeside WTP will be required for all alternatives and therefore not included in the impact analysis. Variations of this component, indicated below, were developed for the four new reservoir sites that passed Phase 1A and 1B screening:

- Glades to Lakeside (TM-002a)
- Lower Mud to Lakeside (TM-002b)
- Upper Mud to Lakeside (TM-002c)
- White Creek to Lakeside (TM-002d)

Figure 2.15 Pipeline Transmission Scenario



Current Policy on Water Passing through a Federal Reservoir

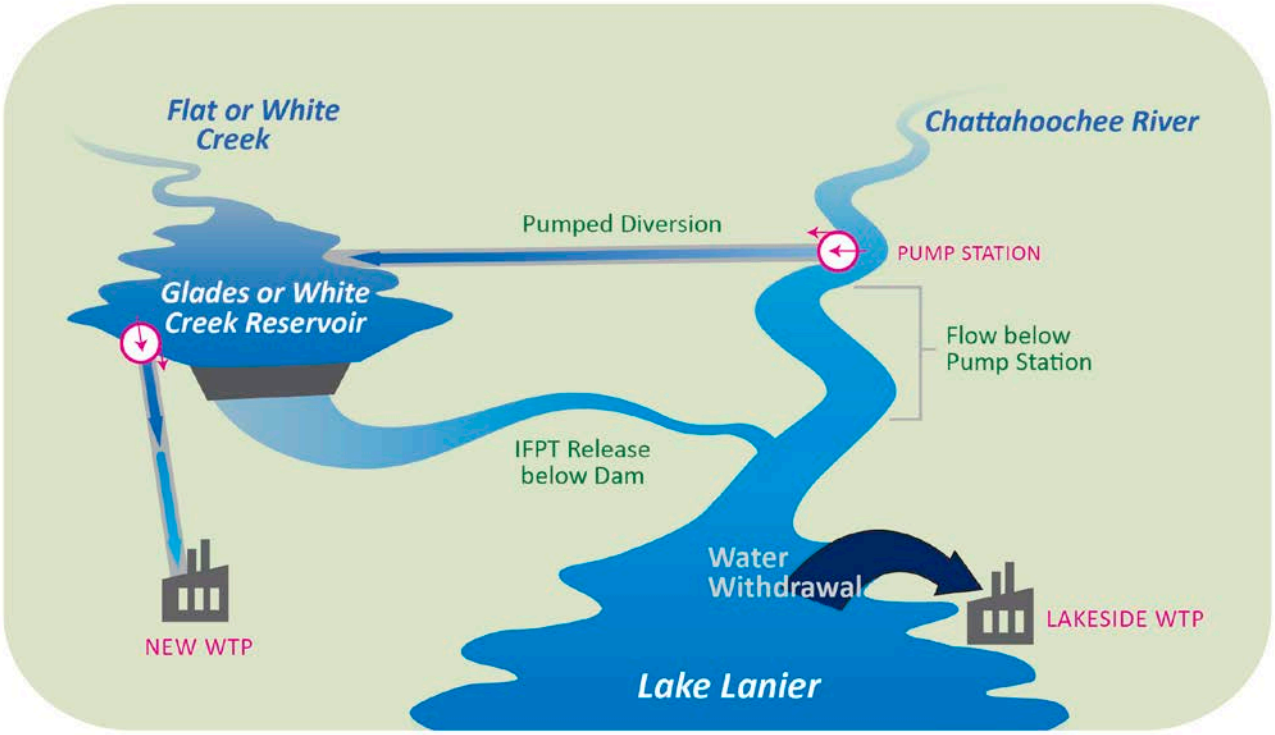
The Corps' current policy does not allow for flow to simply "pass-through" a federal reservoir before being withdrawn for use without a storage contract. The Corps Headquarter is currently evaluating this policy.

Hall County's preferred operation for the Glades Reservoir is to release water below the dam, pass it through Lake Lanier, and withdraw the same quantity at Gainesville's Lakeside water treatment plant (WTP). However, unless the Corps changes its policy to allow flow to "pass-through", this operation is not likely to be implemented. Any withdrawal from Gainesville in addition to its current withdrawal quantity is likely to require a new water storage contract with the Corps (Mobile District).

2.4.7.3 New WTP (TM-003)

The option assumes that the water withdrawal from the proposed reservoir will be treated at a new WTP located at the reservoir prior to distribution to the system, see **Figure 2.16**. This component includes the construction of a new WTP at the site of the proposed reservoir and a finished water main connecting the WTP to the existing distribution system.

Figure 2.16 WTP Transmission Scenario



Georgia's policy regarding "Made inflows" to federal reservoirs

In 2014, Georgia amended its Water Quality Control Rules 391-3-6-.07 Surface Water Withdrawal to clarify its policy regarding "made inflows" to reservoir. The intent of the amendment is to retain and exercise to the fullest extent the State's sovereign authority to control the use and storage of surface water within its boundaries.

"Made inflow to a reservoir" is defined as water that flows into a reservoir 1) after having been released from a storage project upstream of the reservoir as part of a plan approved by the Director; or 2) after having been discharged from a wastewater reclamation plant as part of a plan approved by the Director to increase flows into the reservoir.

In Rule 391-3-6-.07 (16), the amendment states that when a user has contracted for the right to utilize storage space within a reservoir that is owned or operated by an agency of the federal government, the Director shall retain authority to allocate any State water rights subject to regulation under O.C.G.A &12-5-31, including the right to withdraw State waters from the project as well as the right to impound made inflows to the reservoir.

This Georgia policy paves the way for Gainesville/Hall County to withdraw water released from the Glades Reservoir (or its alternative) assuming a potential future "storage contract" for Lake Lanier will be issued for all of or part of the State's water supply request (January 2013). However, unless the Corps changes its current policy to allow "made inflows" to "pass-through" Lake Lanier, this rule is still at odds with the Corps' current policy.

2.5 Phase 2: Formulation and Screening of Alternatives

Following the Phase 1 screening of all components, the final screened components were compiled to form project alternatives based on the project purpose and need. During the Phase 2 screening, these alternatives, along with the Applicant's Proposed project and a "no action" alternative were evaluated against environmental impact criteria. The goal was to generate a final set of EIS alternatives for further in-depth analysis (Chapters 3 and 4).

2.5.1 Definition of Unmet Need

The Applicant's stated need and the Corps need analysis were both described in Chapter 1. To determine the additional 2060 water supply needs for Hall County, the projected 2060 demand is compared to Hall County's existing available water supply from Lake Lanier, groundwater, and Cedar Creek Reservoir. These sources are further defined below.

Lake Lanier

Lake Lanier serves as the primary water supply source for Hall County, with Gainesville maintaining the water system that serves customers in both City of Gainesville and Hall County. The Gainesville water system currently withdraws approximately an annual average quantity of 18 mgd from Lake Lanier. At the time the permit application was submitted (2011) and facing the uncertainly of the Magnuson decision, the Applicant assumed that this quantity would be available to Gainesville/Hall County through 2060 for water supply (2060 Need Certification, 404 permit application) and no additional supply from Lake Lanier above 18 mgd, can be relied upon. In the 404 permit application, the Applicant also described a most optimistic scenario where Gainesville/Hall County could possibly be allowed to withdraw up to 43 mgd (annual average) from Lake Lanier (see Section 2.4.4).

As discussed in Section 1.1.1 (Project Background), the United States Court of Appeals for the Eleventh Circuit overturned the Magnuson decision and the Corps Mobile District is currently updating the Water Control Manual (WCM) for the Apalachicola-Chattahoochee-Flint (ACF) River Basin. As such, the future quantity allocated to Hall County for water supply from Lake Lanier will not be determined until the Corps Mobile District completes the WCM update and associated EIS, adopts the new WCM, and Georgia EPD determines allocation to various withdrawal permit holders based on the quantity authorized by the Corps. Chapter 1.1.1, Project Background, describes the "State of Georgia's Water Supply Request," which is the most recent water allocation requests made by the State. Review of this request is part of the Corps WCM update. This process may take a minimum of 2 to 3 years. Therefore, the Corps baseline alternative is based on an 18-mgd allocation from Lake Lanier, and a range of allocation from 18 mgd to 60 mgd is considered to formulate the water supply alternatives in this EIS.

Groundwater

Groundwater supplies in Hall County are limited. The Applicant assumed that groundwater use will decline as additional surface water becomes available to approximately 2 mgd in 2060, as described in Section 1.6.6.1. However, a review of groundwater availability performed by the EIS team (Groundwater Availability Technical Memorandum, **Appendix F**) concluded that 3.4 mgd is currently permitted (baseline), limited additional

groundwater supplies could be developed and approximately 4.7 mgd of total groundwater supplies could be potentially available in Hall County in 2060. This additional level of groundwater availability (1.3 mgd) is considered a water supply component during alternative formulation.

Cedar Creek Reservoir

The Applicant assumes that the Cedar Creek Reservoir has a safe yield of 7.3 mgd. The permit to withdraw water from Cedar Creek Reservoir was issued in 2002 by Georgia EPD and the safe yield of 7.3 mgd listed in the permit was estimated based on streamflow records available prior to 2002 and the critical drought for the period of analysis was the 1986-1989 drought. Based on an updated yield analysis performed for this EIS (Cedar Creek Reservoir Yield Analysis Technical Memorandum, **Appendix E**), the revised annual average safe yield is 4.3 mgd based on the 2007-2008 critical drought for Cedar Creek Reservoir.

Every water supply alternative was formulated with the following priorities:

- First, maximize practices that will provide additional supply with no or minimal impacts to aquatic ecosystem (ex: policy decisions like water conservation programs)
- Second, select components that will involve minor construction and impacts (ex: purchasing water from an adjacent provider or building new groundwater wells)
- Lastly, move toward major projects such as construction of new surface water sources (reservoirs and other associated pumping and transmission infrastructure).

Table 2.13 summarizes the water supply components that are considered "common" to all alternatives based on the priorities discussed above.

Table 2.13 Summary of components and potential quantity (all value shown in annual average basis)

Component	Possible Values
Components Common to All Alternatives	
Cedar Creek Reservoir	4.3 mgd
Groundwater	4.7 mgd (development of additional 1.3 mgd)
Water Purchase	1.2 mgd (from Jackson County)
Additional Conservation	2.3 mgd (Conservation Scenario 3, Chapter 1)
Additional Components Considered	
Allocation from Lake Lanier	Total allocation of 18, 30, 43, and 60 mgd (additional allocation of 0, 12, 25, and 42 mgd, respectively)
New Reservoir(s)	Glades Reservoir (Flat Creek), Lower Mud Creek, Upper Mud Creek, White Creek
Transmission and Treatment	Method of conveyance for flows from new reservoir to the point of treatment. Options include: PT - release to Lake Lanier and treat at Lakeside WTP PL - pump to Lakeside WTP WTP - pump to new WTP located near proposed reservoir

Table 2.14 summarizes the "additional water supply need" after incorporating the common water supply components for the Applicant's Proposed Project and the Corps' baseline alternative. Based on this analysis, the alternatives developed for this EIS will need to satisfy 42 mgd of additional water supply need. Depending on the

unmet need, selected additional components and suitable quantity are combined with the common components to formulate each water supply alternative and variations of these alternatives.

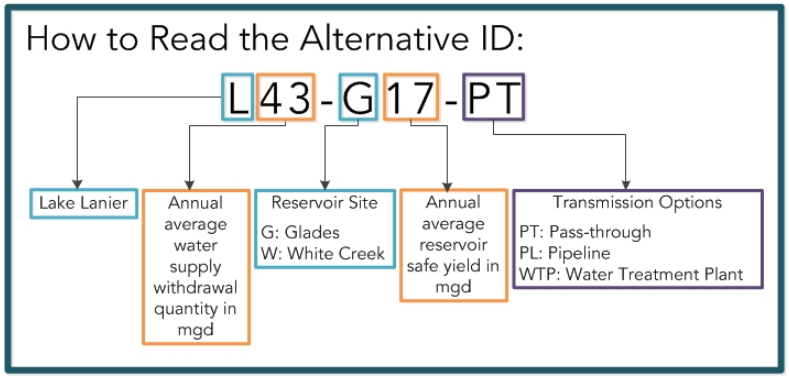
Table 2.14 2060 Additional Water Supply Need – Applicant and Corps Baseline

Quantity (mgd)		
Water Supply Sources	Applicant	Corps Baseline
Existing and Future Water Supply Sources		
Lake Lanier - Existing Allocation[1]	18.0	18.0
Groundwater[2]	2.0	4.7
Cedar Creek Reservoir[3]	7.5	4.3
Water Purchase	0	1.2
Additional Conservation	0	2.3
Total Existing and Future Water Supply Sources	27.5	30.5
Projected Future Demand and Need		
Projected 2060 Water Demand[4]	77.3	72.5[4]
Additional Water Supply Need in 2060	49.8	42.0

[1] Based on actual annual average withdrawal records and this is assumed the allowable withdrawal quantity from Lake Lanier without a storage contract (see Chapter 1 for discussion on Lake Lanier storage contract).
[2] Technical memorandum - Groundwater availability analysis, AECOM, 2013. The available groundwater quantity in the Corps baseline represents estimated permitted quantity (3.4 mgd) and additional groundwater that can be available for development (1.2 mgd).
[3] The approved yield for the Cedar Creek Reservoir in the current permit (issued in 2002) is 7.3 mgd. However, the critical safe yield for the Cedar Creek Reservoir of 4.3 mgd is estimated based on updated streamflow data (1939-2012) that includes the more recent record droughts of 2007-2009, AECOM 2013.
[4] The projected demand is estimated using the demand forecast model (the Least Cost Decision Support System (DSS) Model); detail discussions are in Chapter 1 and its appendices.

2.5.2 Phase 2A: Formulation of Alternatives

In order to meet the identified unmet need of 42 mgd in additional water supply, a series of alternatives were formed by selecting from components listed in **Table 2.13**. The formulated alternatives are detailed in **Table 2.15.**



In addition to the Applicant's Proposed Project, four groups of alternatives have been developed based on Lake Lanier water supply allocation quantities of 18, 30, 43, and 60 mgd, respectively. As the allocation assumption affects the selection of the remaining components for meeting the unmet need (including the safe yield required for new reservoirs), each group of alternative includes multiple variations depending on the combination of components.

Each alternative includes a transmission mechanism for conveying water from the alternative reservoir to a water treatment plant (WTP), including:

- **PT** (pass-through) - This transmission option assumes that water supply from the proposed reservoir will be released downstream of the dam and will flow through Lake Lanier via the creek (tributary to Chattahoochee River upstream of Lake Lanier). **Figure 4.8** shows how the water supplied from the proposed reservoir will be withdrawn from Lake Lanier at the existing intake for Gainesville's Lakeside WTP.
- **PL** (pump to Lakeside WTP) - Instead of "passing through" Lake Lanier, this transmission option assumes that water from the proposed reservoir will be pumped directly to a WTP for treatment, as shown in **Figure 4.9**. Only a flow equivalent to the IFPT would be released downstream of the dam and will flow through Lake Lanier via the creek (tributary to Chattahoochee River upstream of Lake Lanier).
- **WTP (**pump to new WTP) - The option assumes that the water withdrawal from the proposed reservoir will be treated at a new WTP located at the reservoir prior to distribution to the system, as shown in **Figure 4.10**. Only a flow equivalent to the IFPT would be released downstream of the dam and will flow through Lake Lanier via the creek (tributary to Chattahoochee River upstream of Lake Lanier).

Not all reservoir sites can supply the safe yield required under all Lake Lanier allocations. Glades Reservoir and Lower Mud Creek can provide adequate safe yield in all Lanier allocation scenarios, whereas White Creek and Upper Mud Creek can only provide adequate safe yield if the Lanier allocation is 43 mgd or greater. Pass-through and pipeline scenarios were considered for all reservoir sites, new water treatment plants were considered where they could be constructed in Hall County (Upper Mud Creek is located in Habersham County and White Creek is located in White County). Including the Applicant's Proposed Project, a total of 22 alternatives were developed for further evaluation in Phase 2B.

Table 2.15 Formulated Alternatives (all quantities expressed in annual average quantity)

	Alternative Name	Description
0	Applicant's Proposed Project	
	Lake Lanier	Allocation from Lake Lanier at 18 mgd (no additional allocation)
	Cedar Creek Reservoir	Permitted water supply safe yield of 7.3 mgd
	Groundwater	Estimated existing supplies at 2.0 mgd
	Glades Reservoir	Construction of a new pumped-storage reservoir with a safe yield of 50 mgd
	Transmission and Treatment	Flows from the reservoir is release to Lake Lanier for treatment at the Lakeside WTP
1	Alternative Group 1 – 18 mgd from Lanier	
	Lake Lanier- No Additional Allocation	Allocation from Lake Lanier at 18 mgd (no additional allocation)
	Cedar Creek Reservoir	Revised water supply safe yield estimated at 4.3 mgd
	Additional Groundwater	Development of additional groundwater supplies of 1.3 mgd (total 4.7 mgd)
	Water Purchase	Purchase of 1.2 mgd from Jackson County
	Additional Conservation	Additional savings of 2.3 mgd from implementation of more aggressive water conservation and water loss reduction program (Conservation Scenario 3, Chapter 1)
	New Reservoir	Construction of a new pumped-storage reservoir with a safe yield of 42 mgd. Potential sites that can generate this target yield include: G - Glades Reservoir LM - Lower Mud Creek Reservoir
	Transmission and Treatment	Method of conveyance for flows from new reservoir to the Gainesville water system. Options include: PT - release to Lake Lanier and treat at Lakeside WTP PL - pump to Lakeside WTP WTP - pump to new WTP located near proposed Reservoir
	Six Potential Alternatives: L18-G42-PT, L18-G42-PL, L18-G42-WTP, L18-LM42-PT, L18-LM42-PL, L18-LM42-WTP	
2	Alternative Group 2 – 30 mgd from Lanier	
	Lake Lanier- Additional Allocation	Allocation from Lake Lanier at 30 mgd (12 mgd additional allocation)
	Cedar Creek Reservoir	Revised water supply safe yield estimated at 4.3 mgd
	Additional Groundwater	Development of additional groundwater supplies of 1.3 mgd (total 4.7 mgd)
	Water Purchase	Purchase of 1.2 mgd from Jackson County
	Additional Conservation	Additional savings of 2.3 mgd resulted from proposed implementation of more aggressive water loss reduction program. (Conservation Scenario 3, Chapter 1)
	New Reservoir	Construction of a new pumped-storage reservoir with a safe yield of 30 mgd. Potential sites include: G - Glades Reservoir LM - Lower Mud Creek Reservoir
	Transmission and Treatment	Method of conveyance for flows from new reservoir to the Gainesville PUD water system. Options include: PT - release to Lake Lanier and treat and Lakeside WTP PL - pipe to Lakeside WTP WTP - pipe to new WTP located near proposed reservoir
	Six Potential Alternatives: L30-G30-PT, L30-G30-PL, L30-G30-WTP, L30-LM30-PT, L30-LM30-PL, L30-LM30-WTP	

	Alternative Name	Description
3	Alternative Group 3 – 43 mgd from Lanier	
	Lake Lanier - Additional Allocation	Allocation from Lake Lanier increased to 43 mgd (25 mgd additional allocation over existing use)
	Cedar Creek Reservoir	Revised water supply safe yield estimated at 4.3 mgd
	Effluent Return (to Lanier) Credit	No storage contract credit received for wastewater effluent returned to Lake Lanier based on current policy.
	Additional Groundwater	Includes existing permitted groundwater quantity of 3.4 mgd plus additional groundwater supplies estimated at 1.3 mgd
	Water Purchase	Purchase of 1.2 mgd from Jackson County
	Additional Conservation	Additional savings of 2.3 mgd resulted from proposed implementation of more aggressive water loss reduction program. (Conservation Scenario 3, Chapter 1)
	New Reservoir	Construction of a new pumped-storage reservoir with an AAD safe yield of 17 mgd. Sites include: G - Glades Reservoir LM - Lower Mud Creek Reservoir W - White Creek Reservoir UM - Upper Mud Creek Reservoir
	Transmission and Treatment	Method of conveyance for flows from new reservoir to the Gainesville PUD water system. Options include: PT - release to Lake Lanier PL - pump to Lakeside WTP
	Eight Potential Alternatives: L43-G17-PT, L43-G17-PL, L43-LM17-PT, L43-LM17-PL, L43-W17-PT, L43-W17-PL, L43-UM17-PT, L43-UM17-PL	
4	Alternative Group 4 - No Action Alternative – 60 mgd from Lanier	
	Lake Lanier - Additional Allocation	Allocation from Lake Lanier increased to 60 mgd (42 mgd additional allocation over existing use of 18 mgd)
	Cedar Creek Reservoir	Revised water supply safe yield estimated at 4.3 mgd
	Additional Groundwater	Includes existing permitted groundwater quantity of 3.4 mgd plus additional groundwater supplies estimated at 1.3 mgd
	Water Purchase	Purchase of 1.2 mgd from Jackson County
	Additional Conservation	Additional savings of 2.3 mgd resulted from proposed implementation of more aggressive water loss reduction program. (Conservation Scenario 3, Chapter 1)
	New Reservoir	Not needed
	Transmission and Treatment	Transmission pipeline is not needed. Water is withdrawn directly at Gainesville Public Utilities Department's (GPUD's) Lakeside WTP for treatment
	One Potential Alternative: L60	

2.5.3 Phase 2B: Screening of Formulated Alternatives

The goal of the Phase 2B screening was to generate a final set of alternatives to carry forward for further in-depth analysis in the EIS ("EIS alternatives"). Each of the compiled project alternatives were evaluated against environmental impact criteria - including impacts to aquatic ecosystems and terrestrial ecosystems.

Phase 2B incorporated both quantity and quality factors into the impact assessment and focused on a comparative ranking of criteria for each project alternative. The environmental criteria included the following:

- Stream Impacts
- Wetland Impacts

- Federal and State Protected Species
- Displacements

The assessment was based on a systematic review of existing data, maps, aerial photos, and publicly available data from NWI, NHD, and state and federal threatened and endangered species lists. For each criterion, a ranking of 1 to 5 was developed based on both quantity and quality factors, with 5 representing the highest resource impacts. An alternative was subject to elimination if its impact ranking was a 5, or the potential highest impact of any of the alternative.

The following components are common to all alternatives and would not impact the Phase 2 screening:

- Lake Lanier Allocation
- Cedar Creek Reservoir
- Groundwater
- Water Purchase
- Water Conservation

Among the common components within each compiled alternative, some are existing water supply sources (Lake Lanier and Cedar Creek Reservoir) that would result in no additional impacts to wetlands, streams, protected species, or displacements. Other common components (such as additional groundwater development, water purchase and water conservation) may result in minimal impacts to wetlands, streams, protected species, or displacements.

As a result, the Phase 2B screening focused on comparison of potential impacts resulting from construction of new reservoir alternatives and associated pump stations and transmission lines (both transmission from the Chattahoochee River Pump Station and transmission to a water treatment facility.) The impact comparisons are presented based on reservoir site location in this section. **Table 2.16** compares the relationship between the various alternatives and the reservoir and transmission components they include.

Impacts were assessed separately for each water supply component (i.e. reservoir site or pipeline) and then totaled for each alternative to complete the alternative comparison. The following sections describe how the ranking was developed for each environmental criterion.

Table 2.16 Reservoir and Pipeline Components of EIS Alternatives

Reservoir and Transmission Components	Reservoir	River Transmission System (River Intake + Pipeline to Reservoir)	Reservoir Transmission System To Lakeside WTP (Reservoir Intake + Pipeline to WTP)	Reservoir Transmission System To New Reservoir WTP (Reservoir Intake + Pipeline to WTP)
G-PT	X (Glades)	x		
G-PL	X (Glades)	x	x	
G-WTP	X (Glades)	x		x
W-PT	X (White Creek)	x		
W-PL	X (White Creek)	x	x	
W-WTP	X (White Creek)	x		x
UM-PT	X (Upper Mud Creek)	x		
UM-PL	X (Upper Mud Creek)	x	x	
LM-PT	X (Lower Mud Creek)	x		
LM-PL	X (Lower Mud Creek)	x	x	

2.5.3.1 Stream Impact Assessment

The NHD was used to determine stream lengths located within each reservoir footprint at its flood pool, which would be converted from lotic/stream to lentic/pond habitat. Streams that may be impacted along potential pipeline routes were also identified. It is assumed that impacts along all pipeline routes will be temporary in nature (stream crossings), as streams impacted by pipelines will be restored and areas impacted will be re-vegetated after construction. **Figure 2.17** and **Table 2.17** show a comparison between impacts associated with each potential series of alternatives associated with each reservoir site.

Figure 2.17 Phase 2B Screening –Stream Impacts

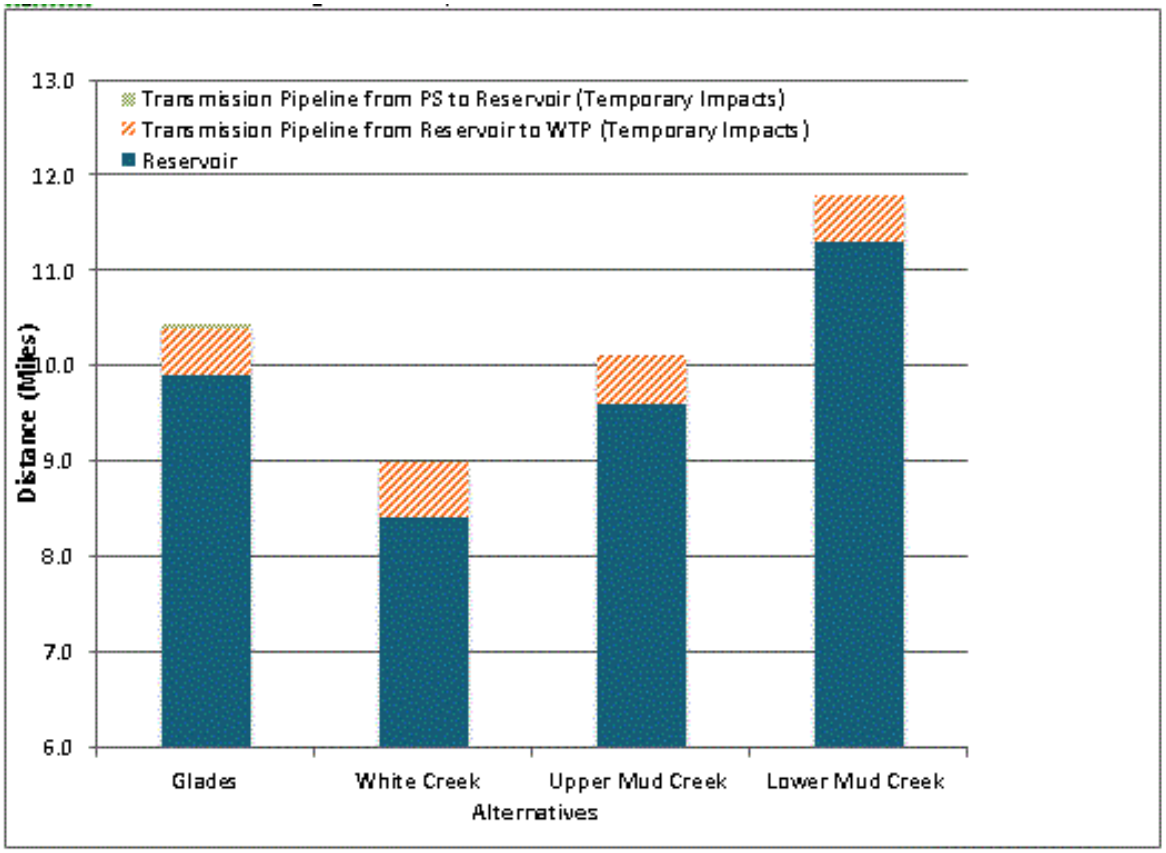


Table 2.17 Phase 2B Screening –Stream Impacts

	Stream Miles		
	Reservoir	Transmission Pipeline from PS to Reservoir (Temporary Impacts)	Transmission Pipeline from Reservoir to WTP (Temporary Impacts)
Glades Reservoir	9.9	0.04	0.5
White Creek Reservoir	8.4	0.0	0.6
Upper Mud Creek Reservoir	9.6	0.0	0.5
Lower Mud Creek Reservoir	11.3	0.0	0.5

In addition to the quantitative evaluation (impacted stream miles) used in Phase 1B screening of components, quality factors were incorporated into the Phase 2B screening to better assess the comparative impacts for each alternative. Three factors, including stream type impacted, priority area, and existing condition, were selected to represent stream quality. The factors were developed using the Corps' standard operating procedure (SOP), Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS; *Stream Mitigation Worksheet 1: Adverse Impact Factors for Riverine Systems* (See **Appendix K**). The definitions of these factors and the basis for scoring them were adopted from the Corps SOP and used for the streams impact assessment, as described below.

Stream Type Impacted

Stream types impacted and their scores are shown in **Table 2.18**. A combination of these stream types were identified for each alternative site.

Table 2.18 Stream Type Scoring

Stream Type[1]	Methodology	Score[1]
Intermittent Streams	determined by dashed line on the USGS quad map	0.1
Perennial Streams less than 15' in width	determined by solid line on the USGS quad map and aerial coverage to assess width	0.4
Perennial Streams greater than or equal to 15' in width	determined by solid line on the USGS quad map and aerial coverage to assess width	0.8

[1] Based on Corps *Stream Mitigation Worksheet 1: Adverse Impact Factors for Riverine;* Standard Operating Procedure, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS, 2004

Priority Area

Priority areas and their scores are shown in **Table 2.19**. To complete the priority area assessment, published data from USFWS and the GDNR, and other sources were reviewed, as shown in **Table 2.19**. The majority of the stream segments assessed were ranked as tertiary priority. However, within the GDNR 3-Mile Coordination Response Letter, Mud Creek and Little Mud Creek were noted as having documented evidence of state protected species, thus they were considered priority reaches per the Corps SOP.

Table 2.19 Priority Area Scoring

Priority Area[1]	Definition[1]	Methodology/Source	Score[1]
Primary Priority	Reaches with species listed as endangered, threatened, or candidate by USFWS or GDNR	GDNR 3-Mile Coordination Response Letter (Appendix S)	1.5
	Primary trout streams	GDNR - County maps of trout streams and listing of stream names by county http://www.georgiawildlife.com/Fishing/Trout?cat=10	
	Streams identified by the GDNR Stream Team as having an excellent or good Index of Biological Integrity (IBI) score[2]	Data maintained by GDNR, and is available through and Agency data request.	
	Waters adjacent to other Corps approved mitigation sites/banks or other protected lands	Corps Regulatory In-lieu fee and Bank Information Tracking System (RIBITS). RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas, as well information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation. https://ribits.usace.army.mil/ribits_apex/f?p=107:2	
	National Estuarine Research Reserves (NERR)	The NERR System is a network of 28 areas representing different biogeographic regions of the United States that are protected for long-term research, water-quality monitoring, education, and coastal stewardship. Established by the Coastal Zone Management Act of 1972, as amended, the reserve system is a partnership program between National Oceanic and Atmospheric Administration (NOAA) and the coastal states. http://www.nerrs.noaa.gov/#Map	
	Reaches in approved greenway corridors	Identified by GDNR Trails and Greenways Program	
	Wild and Scenic Rivers	Georgia has approximately 69,547 miles of river, of which only 49.2 miles of one river are designated as wild & scenic—approximately 7/100ths of 1% of the state's river miles. http://www.rivers.gov/georgia.php	
	Outstanding National Resource Waters (ONRW)	ONRW is a designation granted to waters that are to be afforded the highest level of protection under Tier 3 of the state's antidegradation policy. This designation will be considered for waters of exceptional ecological, recreational, aesthetic, or historic significance, including (but not limited to) those in national or state parks and wildlife refuges. For waters designated as ONRW, existing water quality shall be maintained and protected, and where feasible improved. https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/GA_ONRW_Guidance_2011.pdf	
	Essential Fish Habitat (EFH)	EFH is identified for species managed in Fishery Management Plans under the Magnuson-Stevens Fishery Conservation and Management Act. Essential fish habitat is the habitat necessary for managed fish to complete their life cycle, thus contributing to a fishery that can be harvested sustainably. The National Marine Fisheries Service (NMFS) has interpreted through regulation that EFH must be described and identified for each federally managed species at all life stages for which information is available. Only found in coastal counties. http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html	

Secondary Priority	Waters with species listed as species of concern by USFWS or those listed as rare/uncommon by GDNR	USFWS Information, Planning, and Conservation System (IpaC): Determine whether any threatened and endangered species, designated critical habitat, proposed critical habitat, migratory birds of conservation concern, or other natural resources of concern may be affected by your Proposed Project. http://ecos.fws.gov/ipac/ GDNR - rare species and natural community data are maintained by the Nongame Conservation Section. The protected species lists contain species protected at both the state and the federal level. Special concern lists includes plants, animals, and natural communities that are federally and state protected and also species that are not legally protected but are considered of special conservation concern by staff biologists. GDNR maintains active records for these species and communities in conservation databases. http://www.georgiawildlife.com/conservation/species-of-concern	0.8
	Secondary trout streams	GDNR - County maps of trout streams and listing of stream names by county http://www.georgiawildlife.com/Fishing/Trout?cat=10	
	State Heritage Trust Preserves	State heritage areas are established by states – in the case, by the Georgia Water/Laws/Heritage Trust Act of 1975 http://gastateparks.org/map http://www.georgiawildlife.com/maps/hunting/region2	
	Anadromous fish spawning habitat	Areas with identified habitat would be noted in GDNR 3-mile Coordination Letter	
	Designated shellfish grounds	Areas with identified habitat would be noted in GDNR 3-mile Coordination Letter	
Tertiary Priority	All Other Areas		0.5

[1] Based on Corps *Stream Mitigation Worksheet 1: Adverse Impact Factors for Riverine;* Standard Operating Procedure, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS, 2004

[2] GDNR Excellent Stream IBI Score - comparable to the best ecoregional reference conditions; all regionally expected species for the habitat and stream size, including the most intolerant species are present with a full array of size classes; significant proportion of the sample composed of benthic fluvial specialist and insectivorous cyprinid species; number of individuals abundant, representing a balanced trophic structure. GDNR Good Stream IBI Score -species richness somewhat below expectation, especially due to the loss of the most intolerant forms; good number of individuals, with several species of suckers, minnows, and benthic invertivores present; trophic structure shows some signs of stress.

Existing Condition

Table 2.20 summarizes the types of existing conditions and their associated scores.

Table 2.20 Existing Condition Scoring

	Score
Fully Impaired	0.25
Somewhat impaired	0.5
Fully Functional	1.0

Note: Based on Corps *Stream Mitigation Worksheet 1: Adverse Impact Factors for Riverine;* Standard Operating Procedure, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS, 2004

Impairment was judged by review of (1) aerial photograph coverage to look for impacts to the stream such as straightening, clearing, or agricultural use adjacent to the stream; and (2) 303(d) list of impaired streams where this data was available. The majority of streams are scored as somewhat impaired or fully impaired; most have long entrenched portions, some level of erosional issues, and/or silt/sand/sediment problems. Only Mud Creek and Little Mud Creek were scored as fully functional (1.0), given the existence of state protected species identified within those streams.

Total Scoring

A combined stream impact score for each new reservoir component and associated pump stations and transmission lines was based on the assessment of stream segments within the component area (per stream sections identified in the NHD. The scoring was conducted in the following steps:

1) The stream type, priority area, and existing condition scores of each stream segment were added up to calculate the segment's quality rating.

2) A weighted total for each stream segment was determined by multiplying the quality rating by the percentage of the total stream impacts that one segment comprises.

3) The component's average quality rating was calculated by adding the up the weighted total scores for all stream segments.

4) The component's total stream impact score was calculated by multiplying the total stream length in miles by the average quality rating.

An example of stream scoring is shown in **Table 2.21.**

Table 2.21 Sample Stream Scoring – Glades Reservoir Site

Reach		Stream Length (Feet)	Stream Type	Priority Area	Existing Condition	Quality Rating[1]	Weighted Total[2]
1A	Flat Creek	844.94	0.8	0.5	0.50	1.8	0.03
1B	Flat Creek	3,697.85	0.8	0.5	0.25	1.6	0.11
1C	Flat Creek	1,422.44	0.8	0.5	0.25	1.6	0.04
1D	Flat Creek	4,596.26	0.8	0.5	0.25	1.6	0.14
1E	Flat Creek	4,717.85	0.8	0.5	0.50	1.8	0.16
1F	Flat Creek	1,433.48	0.8	0.5	0.50	1.8	0.05
1G	Flat Creek	5,013.29	0.8	0.5	0.50	1.8	0.17
2	unnamed tributary	3,481.26	0.4	0.5	0.50	1.4	0.09
3A	unnamed tributary	4,120.70	0.1	0.5	0.25	0.9	0.07
3B	unnamed tributary	2,433.07	0.1	0.5	0.50	1.1	0.05
4	unnamed tributary	2635.7	0.1	0.5	0.25	0.9	0.04
5A	unnamed tributary	949.44	0.4	0.5	0.25	1.2	0.02
5B	unnamed tributary	1,281.46	0.4	0.5	0.50	1.4	0.03
5C	unnamed tributary	5,972.69	0.4	0.5	0.50	1.4	0.16
6	unnamed tributary	2,895.62	0.1	0.5	0.50	1.1	0.06
7A	unnamed tributary	1,614.92	0.4	0.5	0.50	1.4	0.04
7B	unnamed tributary	905.56	0.4	0.5	0.50	1.4	0.02
8	unnamed tributary	723.81	0.4	0.5	0.50	1.4	0.02
9	unnamed tributary	2,329.01	0.1	0.5	0.50	1.1	0.05
10	unnamed tributary	1,305.8	0.1	0.5	0.50	1.1	0.03
11	unnamed tributary	2.82	0.1	0.5	0.50	1.1	0.00
TOTAL		52,377.96				AVERAGE[3]	1.39
COMBINED STREAM IMPACT SCORE = 14.9 [1.39 (Average Quality Score) x 9.9miles (Stream Length 52,378 ft.)]							

[1] Quality rating is the sum of stream type, priority area, and existing condition scores.

[2] Weighted total is the quality rating divided by the stream length

[3] Average quality rating is the sum of the weighted total score for every stream segment in the water supply component

2.5.3.2 Wetland Impact Assessment

The NWI maps were used to determine wetland and other-waters acreages that would either be inundated by water at its flood pool or filled due to constructing and operating the reservoir and pipeline. It is assumed that impacts along all pipeline routes will be temporary in nature as wetland area will be restored and areas impacted will be re-vegetated after construction. **Figure 2.18** and **Table 2.22** show a comparison between wetland impacts from components associated with each reservoir site.

Figure 2.18 Phase 2 Screening –Wetland Impacts

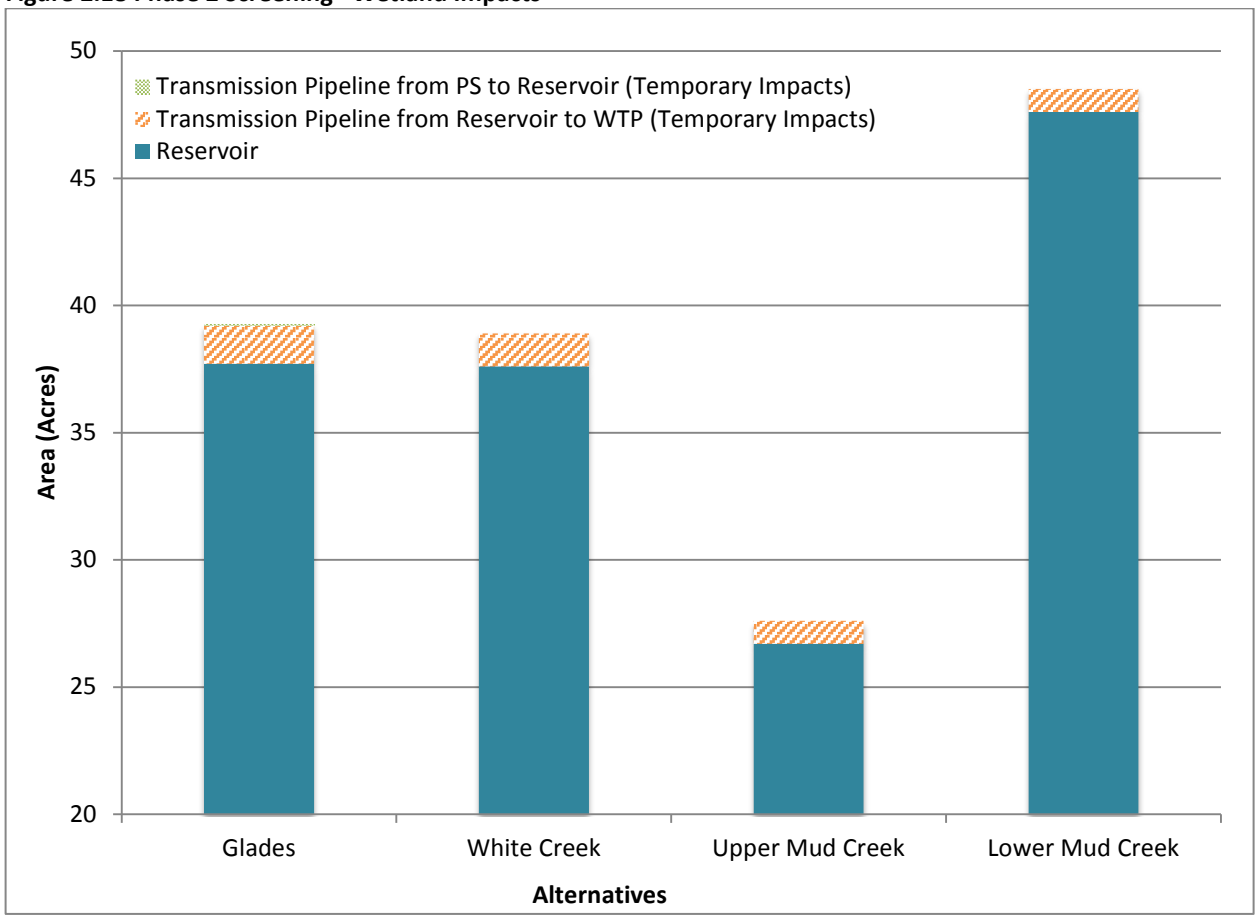


Table 2.22 Phase 2 Screening –Wetland Impacts

Wetlands (acre)	Reservoir	Transmission Pipeline from PS to Reservoir (Temporary Impacts)	Transmission Pipeline from Reservoir to WTP (Temporary Impacts)
Glades Reservoir	37.7	0.0	1.5
White Creek Reservoir	37.6	0.0	1.3
Upper Mud Creek Reservoir	26.7	0.0	0.9
Lower Mud Creek Reservoir	47.6	0.0	0.9

In addition to the quantitative evaluation (impacted wetland acres) used in Phase 1B screening of components, quality factors were incorporated into screening to better assess the comparative wetlands impacts for each alternative. Three factors, including existing condition, lost kind, and rarity ranking, were selected to represent wetlands quality. The factors were developed using the Corps' SOP, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS; *Mitigation Worksheet for Wetlands and Open Waters*. The definitions of these factors and the basis for scoring them were adopted from the Corps SOP and used for the wetlands impact assessment, as described below.

Existing Condition

Existing condition is defined within the Corps SOP in several classes of wetland, with associated scores ranging from 2.0 for Class 1 to 0.1 for Class 5, as is detailed in **Table 2.23**. For this screening, each wetland was identified

through NWI coverage and was evaluated through desktop assessment by viewing various available aerial photographs of the potentially impacted area. Given the agricultural nature of the project area, most wetlands show signs of previous impacts and were scored a Class 3, with Class 4 or 5 being assigned to wetlands that appear to have been ditched, drained, farmed, or non-wetland in appearance.

Table 2.23 Existing Condition Definition and Score

	Definition	Example	Impact Factor
Class 1	Fully functional wetland	Mixed species hardwood forest with 40-year old or older dominant canopy trees, and no evidence of hydrologic alteration	2.0
Class 2	Adverse impacts to aquatic function are minor and would fully recover without assistance	Mixed species hardwood forest with 20 to 40-year old dominant canopy trees, and no evidence of hydrologic alteration	1.5
Class 3	Adverse impacts to aquatic functions are minor and would not fully recover without some minor enhancement activity	Mixed species 10 to 20-year old hardwoods with evidence of minor hydrologic alteration (i.e., few shallow ditches)	1.0
Class 4	Major adverse impacts to aquatic function and substantial enhancement would be necessary to regain lost aquatic functions	Clear-cut/cutover 0 to 10-year old stand dominated by early successional tree species (i.e., gums, maples, willows, etc.), and lacking many indigenous mast-producing hardwood species. In addition, these areas may have extensive hydrologic alteration (i.e., network of drainage ditches and canals) (0.5 impact factor).	0.5
Class 5	Most aquatic function has been lost.	Intensively managed pine plantations or farmed wetlands.	0.1

Note: Based on Corps *Mitigation Worksheet for Wetlands and Open Waters: Adverse Impact Factors for Riverine;* Standard Operating Procedure, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS, 2004

Lost Kind

Lost kind is defined in several categories within the Corps SOP, based on functional values of the wetland system (**Table 2.24**). For the lost kind screening, each wetland area was assessed by (1) assessing wetland classification in the NWI coverage and (2) reviewing recent and historical aerial photographs. Most of the impacted wetlands were classified as lacustrine (lake) or palustrine (marsh) systems. No Riverine (River) wetlands were identified in our assessment.

Table 2.24 Lost Kind Definition and Score

Kind	Definition	Score
A	Riverine forested wetlands; intertidal wetlands	2.0
B	Non-riverine forested wetlands; freshwater areas adjacent to tidal areas	1.5
C	Pine flatwood wetlands	1.0
D	Lakes and impoundments	0.5
E	Naturalized borrow pits	0.1

Note: Based on Corps *Mitigation Worksheet for Wetlands and Open Waters: Adverse Impact Factors for Riverine;* Standard Operating Procedure, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS, 2004

Rarity

Rarity of each wetland area was determined based on the "rarity ranking" classification in the Corps' SOP (**Table 2.25**). Categories are determined based on information furnished by USFWS and/or the GDNR or other available

data. For the Phase 2B screening, all of the wetland areas assessed were assigned a rarity ranking of 0.1, as none of the areas have been specially identified by USFWS or GDNR as rare or uncommon.

Table 2.25 Rarity Definition and Score

Rarity		
Rare	Designated category is seldom occurring and is marked by some special quality	2.0
Uncommon	designated category is not ordinarily encountered or is of exceptional quality	0.5
Common	designated category is frequently occurring or widespread in distribution	0.1

Note: Based on Corps *Mitigation Worksheet for Wetlands and Open Waters: Adverse Impact Factors for Riverine;* Standard Operating Procedure, Compensatory Mitigation, WETLANDS, OPENWATER & STREAMS, 2004

Total Scoring

A combined stream impact score for each component associated with each reservoir site was based on assessment of wetland areas identified in the NWI. The scoring was conducted in the following steps:

1) The existing condition, lost kind, and rarity scores of each wetland area were added up to calculate the quality rating for each wetland area.
2) A weighted total quality score for each wetland area was determined based on percentage that wetland area comprised of the total impacted wetlands for a component.
3) The component's overall quality rating was calculated by summarizing the weighted quality scores for all impacted wetland areas.
4) The component's combined wetlands impact score was calculated by multiplying the overall wetland quality score by the impacted acres.

An example of stream scoring is shown in **Table 2.26.**

Table 2.26 Sample Stream Scoring – Glades Reservoir Site

ID	Wetland Type		Acres	Existing Condition	Lost Kind	Rarity Ranking	Quality Score	Weighted Total
36202	PSS1Cb	Freshwater Forested/Shrub Wetland	6.9	1.0	1.5	0.1	2.6	0.5
114079	PEM1C	Freshwater Emergent Wetland	0.7	1.0	1.5	0.1	2.6	0.0
144046	PEM1A	Freshwater Emergent Wetland	0.4	0.1	1.0	0.1	1.2	0.0
159055	PEM1C	Freshwater Emergent Wetland	0.9	1.0	1.5	0.1	2.6	0.1
193893	PEM1A	Freshwater Emergent Wetland	0.3	0.1	1.0	0.1	1.2	0.0
226652	PFO1A	Freshwater Forested/Shrub Wetland	4.2	1.0	1.5	0.1	2.6	0.3
232975	PSS1Fb	Freshwater Forested/Shrub Wetland	0.2	1.0	1.5	0.1	2.6	0.0
288778	PEM1A	Freshwater Emergent Wetland	0.1	0.1	1.0	0.1	1.2	0.0
323436	PEM1A	Freshwater Emergent Wetland	2.7	0.1	1.0	0.1	1.2	0.1
360688	PEM1C	Freshwater Emergent Wetland	2.3	0.1	1.0	0.1	1.2	0.1
361879	PSS1Ch	Freshwater Forested/Shrub Wetland	2.9	1.0	1.5	0.1	2.6	0.2
385876	PFO1A	Freshwater Forested/Shrub Wetland	2.6	1.0	1.5	0.1	2.6	0.2
417988	PSS1Cb	Freshwater Forested/Shrub Wetland	1.8	1.0	1.5	0.1	2.6	0.1
429057	PSS1Fb	Freshwater Forested/Shrub Wetland	0.5	1.0	1.5	0.1	2.6	0.0
429918	PSS1Fb	Freshwater Forested/Shrub Wetland	1.9	1.0	1.5	0.1	2.6	0.1
450947	PSS1Fb	Freshwater Forested/Shrub Wetland	1.0	1.0	1.5	0.1	2.6	0.1
517746	PUBHh	Freshwater Pond	8.3	1.0	0.5	0.1	1.6	0.4
TOTAL			37.7				AVERAGE[3]	2.2
COMBINED WETLAND IMPACT SCORE = 81.4 [2.2 (Average Quality Score) x 37.7 acres]								

[1] Quality rating is the sum of wetland existing condition, lost kind, and rarity scores.
[2] Weighted total is the quality rating divided by the area
[3] Average quality rating is the sum of the weighted total score for every wetland area in the water supply component

2.5.3.3 Federal and State Protected Species

Under the Endangered Species Act of 1973 (ESA; 16 U.S.C. § 1531 et seq.), species may be listed as either endangered or threatened. “Endangered” means a species is in danger of extinction throughout all or a significant portion of its range. “Threatened” means a species is likely to become endangered within the foreseeable future. The ESA protects endangered and threatened species and their habitats by prohibiting the “take” of listed animals. Section 7 of the ESA requires Federal agencies to use their legal authorities to promote the conservation purposes of the ESA and to consult with the USFWS and National Marine Fisheries Service (NMFS), as appropriate, to ensure that effects of actions they authorize, fund, and carry out are not likely to jeopardize the continued existence of listed species. There are two stages of consultation: informal and formal.

Formal consultation is the consultation process conducted when a Federal agency determines its action may affect a listed species or its critical habitat, and is used to determine whether the proposed action may jeopardize the continued existence of listed species or adversely modify critical habitat. This determination is stated in the Service's biological opinion. Informal consultation precedes formal consultation and includes any form of communication between the Federal action agency, applicant, or designated non Federal representative and the Service to determine if listed species may occur in the action area and what the effects of the action

may be to such species. This phase is often used to develop project modifications or alternatives to avoid adverse effects to listed species, which would then preclude the need for formal consultation.

Early coordination with GDNR and USFWS has been used as a screening tool in order minimize impacts to protected species, the cost of mitigation for impacts to listed species, and to reduce the potential for impacting species that may be listed in the future. Although candidate species and proposed listed species receive no statutory protection under the ESA, both candidate and proposed listed species have been included in the early coordination efforts. Candidate species are those for which the USFWS has enough information to warrant proposing them for listing but is precluded from doing so by higher listing priorities. Proposed listed species are those species that were found to warrant listing as either threatened or endangered and were officially proposed as such in a Federal Register notice after the completion of a status review and consideration of other protective conservation measures. The USFWS encourages cooperative conservation efforts for candidate and proposed listed species because they are, by definition, species that may warrant future protection under the ESA. Addressing the needs of species before the regulatory requirements associated with listed species come into play often allows greater management flexibility to stabilize or restore these species and their habitats.

Species potentially impacted by each project alternative that would require formal Section 7 consultation and those that have already undergone informal discussions with USFWS were identified through a review of available published data, including:

- USFWS - IPaC System: This database was used to identify federally protected species by county.
- USFWS – Inter-agency consultation: These discussions were used to confirm the candidate and proposed listed species within the regions of all project alternatives.
- GDNR WRD, Rare Species by Quarter Quad: This was used to identify state protected species by quarter quad – only terrestrial species were selected from this list.
- GDNR WRD, Rare Species by HUC-10: This was used to identify state protected species by HUC-10 and only aquatic species were selected from this list.

The number of protected species potentially impacted was counted for each alternative, and a score was developed based on the level of protection and the need for a formal Section 7 consultation (i.e. higher score for federally listed threatened and endangered species given that formal Section 7 consultation would be required). For pipeline components of any alternative, these portions of the projects were assumed to have similar and negligible impacts since all proposed pipeline corridors are in previously cleared areas along existing right-of-ways.

For each identified threatened or endangered species, a protection score was assigned for each water supply component associated with new reservoir sites, as follows:

- State Listed as Threatened or Endangered - 1
- Federally Listed as Threatened or Endangered - 2

For each water supply component, an average protection score was developed and multiplied by the number of threatened or endangered species potentially impacted by that component to achieve a total impact score.

Displacements

For the Phase 2B screening, a more detailed assessment of structures was conducted than what was previously conducted for the Phase 1B screening. In addition to examining recent aerial photographs to identify residences, commercial structures, and roads within each reservoir footprint, all structures were inventoried for conditions and usage. All structures were field verified via windshield assessment to identify any structures that were in extreme disrepair and uninhabitable conditions. The usages of the structures were further classified as primary (house, business, or chicken house) or secondary (barn, garage, or outbuilding).

Additionally, where road displacements would be necessary, the potential impact of these displacements was further researched by reviewing aerial photographs to determine whether roads were thoroughfares or dead ends. In the case of thoroughfares, these roads will either need to be ended, re-routed, or bridged. The Georgia Department of Transportation (GDOT) State Traffic and Report Statistics (STARS) database was consulted to characterize the usage and importance of the road. Roadways were also further classified as primary or secondary based on use and reported traffic counts.

Although the proposed pipelines will have to traverse roadway crossings, installation of pipelines will not permanently displace any roads; only minor impacts such as road cuts and temporary closures will be encountered. Thus, displacement counts are limited to reservoir-related impacts only.

Table 2.27 lists the number of potential displacements that were identified in the Phase 2B screening process. Displacements were weighted as follows:

- Primary displacements = 1.0
- Secondary displacements = 0.5
- Uninhabitable structures = 0.25

For each water supply component, a total displacement score was developed by weighting each displacement by the above factors then summarizing across the component to achieve a total impact score.

Table 2.27 Phase 2 Screening –Displacements

Reservoir	Structures			Roadways		Composite Score
	Primary (x1.0)	Secondary (x0.5)	Uninhabitable (x0.25)	Primary (x1.0)	Secondary (x0.25)	
Glades Reservoir	0	1	4	0	1	2.00
White Creek Reservoir	4	4	3	0	7	10.25
Upper Mud Creek Reservoir	13	4	0	1	10	21.00
Lower Mud Creek Reservoir	4	1	0	0	4	7.00

Results of Impact Comparisons

Using the impact assessment procedures described above, the cumulative impacts for each alternative were calculated and associated quality factors were developed. The sum of the impact and the quality factors were totaled for each component within each alternative (see **Table 2.28**). Some components like water allocation from Lake Lanier, Cedar Creek Reservoir, groundwater, water purchase, and conservation have no additional

impacts. Once all components within each alternative were developed, a total score was calculated for each alternative, and then the relative impact within each criterion was ranked from 1 (lowest) to 5 (highest). Any alternative that scored a 5, indicating it has the most impacts, in any one category, was subject to elimination (see **Table 2.29**).

Table 2.28 Phase 2 Screening – Summary of Quantity (Impact) and Quality Scores

Infrastructure Components	Streams[1]			Wetlands[1]			Threatened & Endangered Species[2]			Displacements[3]		
	Quantity (mi)	Quality	Total[1]	Impact (Acres)	Quality Factor	Total	Impact (# species)	Protection Factor	Total	# Buildings	# Roads	Total Score
Alternatives L18-G42-PT, L30-G30-PT, L43-G17-PT			14.0			81.4			8.0			2.0
Glades Reservoir	9.9	1.4	13.8	37.7	2.2	81.4	5.0	1.6	8.0	5	1	2.0
Pump Station (PS) at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Alternatives L18-G42-PL, L30-G30-PL, L43-G17-PL			14.6			82.1			8.0			2.0
Glades Reservoir	9.9	1.4	13.8	37.7	2.2	81.4	5.0	1.6	8.0	5	1	2.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Reservoir Water Transmission System	0.5	1.3	0.6	1.5	0.4	0.7	0.0	0.0	0.0	0	0	0
Alternatives L18-G42-WTP, L30-G30-WTP			14.0			81.4			13.0			2.0
Glades Reservoir	9.9	1.4	13.8	37.7	2.2	81.4	7.0	1.9	13.0	5	1	2.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
New WTP at Glades Reservoir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Alternatives L18-LM42-PT, L30-LM30-PT, L43-LM17-PT			27.2			96.7			13.0			7.0
Lower Mud Creek Reservoir	11.3	2.4	27.0	47.6	2.0	96.7	7.0	1.9	13.0	6	4	7.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Alternatives L18-LM42-PL, L30-LM30-PL, L43-LM17-PL			27.8			97.3			13.0			7.0
Lower Mud Creek Reservoir	11.3	2.4	27.0	47.6	2.0	96.7	7.0	1.9	13.0	6	4	7.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0

Draft Environmental Impact Statement

Infrastructure Components	Streams[1]			Wetlands[1]			Threatened & Endangered Species[2]			Displacements[3]		
	Quantity (mi)	Quality	Total[1]	Impact (Acres)	Quality Factor	Total	Impact (# species)	Protection Factor	Total	# Buildings	# Roads	Total Score
Reservoir Water Transmission System	0.5	1.2	0.6	0.9	0.7	0.7	0.0	0.0	0.0	0	0	0
Alternatives L18-LM42-WTP, L30-LM30-WTP			27.2			96.7			13.0			7.0
Lower Mud Creek Reservoir	11.3	2.4	27.0	47.6	2.0	96.7	7.0	1.9	13.0	6	4	7.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
New WTP at Lower Mud Creek Reservoir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Alternative L43-W17-PT			11.3			63.7			7.0			10.3
White Creek Reservoir	8.4	1.3	11.1	37.6	1.7	63.7	4.0	1.8	7.0	11	7	10.3
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Alternative L43-W17-PL			12.0			64.3			7.0			10.3
White Creek Reservoir	8.4	1.3	11.1	37.6	1.7	63.7	4.0	1.8	7.0	11	7	10.3
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Pipe to Lakeside WTP	0.6	1.3	0.7	1.3	0.5	0.7	0.0	0.0	0.0	0	0	0
Alternative L43-UM17-PT			21.8			58.7			11.0			21.0
Upper Mud Creek Reservoir	9.6	2.3	21.7	26.7	2.2	58.7	6.0	1.8	11.0	17	11	21.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Alternative L43-UM17-PL			22.5			59.3			11.0			21.0
Upper Mud Creek Reservoir	9.6	2.3	21.7	26.7	2.2	58.7	6.0	1.8	11.0	17	11	21.0
Pump Station at Chattahoochee River	0.1	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
River Water Transmission System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Reservoir Water Transmission System	0.5	1.3	0.7	0.9	0.7	0.7	0.0	0.0	0.0	0	0	0

Notes:

1. Total stream and wetland impacts were calculated by developing a quality factor and multiplying it by the total area (miles or acres) potentially impacted by the alternative
2. Threatened and endangered species impacts were calculated by counting the potentially present species and multiplying the sum by a composite protection factor based on federal and state listing.
3. Displacement impacts were calculated by counting the buildings and roadways potentially displaced by the project. Each building or road was weighted by a factor based on its use and condition before determining the total score.

Alternative Naming Key:
L18 = 18 mgd Total Allocation from Lake Lanier
L30 = 30 mgd Total Allocation from Lake Lanier
L43 = 43 mgd Total Allocation from Lake Lanier
G = Glades Reservoir
LM = Lower Mud Creek Reservoir
W = White Creek Reservoir
UM = Upper Mud Creek Reservoir
PT = Reservoir raw water release to downstream creek, pass-through to Lanier for withdrawal
PL = Raw water directly piped from the reservoir to the existing Lakeside WTP
WTP = New WTP to be constructed at new reservoir site

Table 2.29 Phase 2 Screening – Results

	Streams		Wetlands		T&E Species		Displacements		Status
	Score	Rank	Total	Rank	Total	Rank	Total	Rank	
L18-G42-PT	13.8	1	81.4	3	8.0	1	2.0	1	
L18-G42-PL	14.6	2	82.0	4	8.0	1	2.0	1	
L18-G42-WTP	14.0	1	81.4	3	8.0	1	2.0	1	
L18-LM42-PT	27.2	5	96.7	5	13.0	5	7.0	2	Eliminated
L18-LM42-PL	27.8	5	97.3	5	13.0	5	7.0	2	Eliminated
L18-LM42-WTP	27.2	5	96.7	5	13.0	5	7.0	2	Eliminated
L30-G30-PT	13.8	1	81.4	3	8.0	1	2.0	1	
L30-G30-PL	14.6	2	82.0	4	8.0	1	2.0	1	
L30-G30-WTP	14.0	1	81.4	3	8.0	1	2.0	1	
L30-LM30-PT	27.2	5	96.7	5	13.0	5	7.0	2	Eliminated
L30-LM30-PL	27.8	5	97.3	5	13.0	5	7.0	2	Eliminated
L30-LM30-WTP	27.2	5	96.7	5	13.0	5	7.0	2	Eliminated
L43-G17-PT	13.8	1	81.4	3	8.0	1	2.0	1	
L43-G17-PL	14.6	2	82.0	4	8.0	1	2.0	1	
L43-LM17-PT	27.2	5	96.7	5	13.0	5	7.0	2	Eliminated
L43-LM17-PL	27.8	5	97.3	5	13.0	5	7.0	2	Eliminated
L43-W17-PT	11.3	1	63.7	1	7.0	1	10.3	3	
L43-W17-PL	12.0	1	64.3	1	7.0	1	10.3	3	
L43-UM17-PT	21.8	4	58.7	1	11.0	4	21.0	5	Eliminated
L43-UM17-PL	22.5	4	59.3	1	11.0	4	21.0	5	Eliminated

Notes:
Alternative Naming Key:
L18 = 18 mgd Allocation from Lake Lanier
L30 = 30 mgd Allocation from Lake Lanier
L43 = 43 mgd Allocation from Lake Lanier
G = Glades Reservoir
LM = Lower Mud Creek Reservoir
W = White Creek Reservoir
UM = Upper Mud Creek Reservoir
PT = Reservoir raw water release to downstream creek, pass-through to Lanier for withdrawal
PL = Raw water directly piped from the reservoir to the existing Lakeside WTP
WTP = New WTP to be constructed at new reservoir site

Through the Phase 2B screening process, 10 alternatives were identified for elimination because of highest impacts in one or more categories. As a result of this screening, alternatives including the proposed Upper Mud and Lower Mud Creek Reservoir sites have been eliminated due to higher impacts. Twelve alternatives remain and will be carried forward as EIS Alternatives. **Appendix K** summarizes the eliminated alternatives and the assumptions/reasons for elimination.

2.6 Overview of Screened EIS Alternatives

2.6.1 Applicant's Proposed Project

The Applicant's Proposed Project is the construction of Glades Reservoir to meet the County's unmet water supply needs. This alternative is described in Chapter 1.1.2.

Project elements of Hall County's updated proposed alternative include an 11.7-BG Reservoir along Flat Creek, a 37-mgd raw water intake and pump station on the Chattahoochee River, 21,500 linear feet (LF) of 48-inch diameter ductile iron transmission pipeline between the Chattahoochee River and the proposed reservoir. It is anticipated that this proposed alternative could support an average daily safe yield of 50 mgd. This alternative assumes that water supply will be released into Flat Creek and flow from Flat Creek to Lake Lanier via the Chattahoochee River. Water supplied from the reservoir will be withdrawn from Lake Lanier at the raw water intake for the existing Lakeside WTP. This alternative assumes that the existing withdrawal permit will be increased to account for the flows transferred from the Glades Reservoir. Future expansion of Lakeside WTP and its raw water intake for Lake Lanier is required; however, the plant and distribution system expansions are not included in infrastructure comparison as it will be required for all alternatives.

In order to construct the Applicant's Proposed Project, relocation/reconfiguration of Glade Farm Road is required. The existing road will be terminated and re-routed around the proposed reservoir.

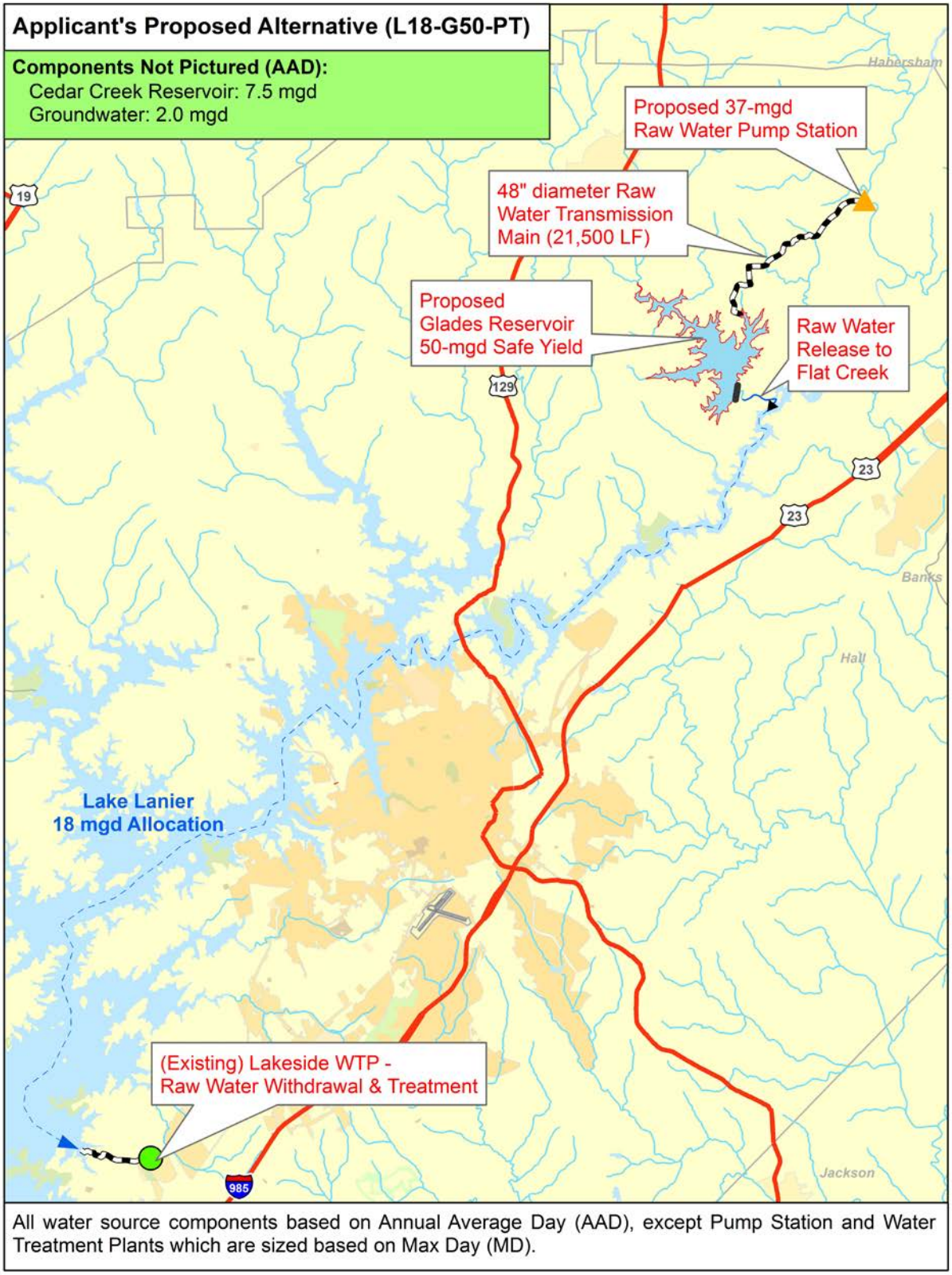
An overview of the Applicant's Proposed Project is included in **Table 2.30** and **Figure 2.19**.

Table 2.30 Construction Elements in Applicant's Proposed Project (L18-G50-PT)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 50 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (four 800-HP pumps) with firm capacity (maximum day) of 37 mgd
	21,500-feet, 48-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing maximum daily quantity of 75 mgd Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Release to Lake Lanier via Flat Creek/Chattahoochee River and treat at Lakeside WTP

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5.

Figure 2.19 Project Elements in Applicant's Proposed Project (L18-G50-PT)



2.6.2 No Action Alternative (L60)

The guidance "Forty Most Asked Questions Concerning CEQ's NEPA Regulations (March 1981)" presents direction on the "no action" alternative (see text box below). In **Appendix B** of 33 CFR Part 325 (Processing of Department of the Army Permits), the No Action Alternative (NAA) is defined as, "one which results in no construction requiring a Corps permit." The section goes on to explain that the NAA, "[…] may be brought by (1) the applicant electing to modify his proposal to eliminate work under the jurisdiction of the Corps or (2) by the denial of the permit. District engineers, when evaluating this alternative, should discuss, when appropriate, the consequences of other likely uses of a project site, should the permit be denied."

2.6.2.1 No Action Alternative for this EIS

In this EIS *"no action" means "no proposed Glades Reservoir project," or* no permit action from the Corps for the Proposed Project in accordance with the second interpretation in CEQ (see text box below). For this EIS, the "No Action Alternative" considers what Hall County would do to meet its water supply needs if it does not obtain a Section 404 permit for the proposed Glades Reservoir Project. The resulting environmental effects from taking no action are compared with the effects of permitting the proposed Glades Reservoir project or an alternative activity (action alternative).

CEQ Guidance on No Action Alternative (*emphasis added below to highlight key points***)**
Forty Most Asked Questions Concerning CEQ's NEPA Regulations (March 1981)

Section 1502.14(d) requires the alternatives analysis in the EIS to "include the alternative of no action." **There are two distinct interpretations of "no action" that must be considered, depending on the nature of the proposal** being evaluated. The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases "no action" is "**no change" from current management direction or level of management intensity**. To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan. In this case, alternatives would include management plans of both greater and lesser intensity, especially greater and lesser levels of resource development.

The **second interpretation of "no action**" is illustrated in instances involving federal decisions on proposals for projects. "No action" in such cases would mean **the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward.**

Where a choice of "no action" by the agency would result in predictable actions by others, this consequence of the "no action' alternative should be included in the analysis. For example, if denial of permission to build a railroad to a facility would lead to construction of a road and increased truck traffic, the EIS should analyze this consequence of the "no action" alternative.

In light of the above, it is difficult to think of a situation where it would not be appropriate to address a "no action" alternative. Accordingly, the regulations require the analysis of the no action alternative even if the agency is under a court order or legislative command to act. This analysis provides a benchmark, enabling decision-makers to compare the magnitude of environmental effects of the action alternatives.

2.6.2.2 Assumptions and Conditions for the "No Action Alternative"

In the event that a Section 404 permit for the proposed Glades project is not issued, Hall County has indicated that it would need to meet its future demand through its existing water supply sources. This means Hall County would rely on withdrawing water, as authorized under current agreements with EPD, from Lake Lanier and ultimately Cedar Creek Reservoir. Additional sources such as groundwater could also be pursued without requiring a Corps permit, and Gainesville (which currently operates the Hall County water system through the 2006 Intergovernmental Agreement with Hall County) would continue to develop and implement its NRW reduction, leak detection, meter replacement, and conservation programs described in Chapter 1, **Appendix D**, of this EIS. In addition to its existing allocation of 18 mgd, Hall County would have no choice but to aggressively pursue the maximum allocation from Lake Lanier, even though the uncertainty associated with maximum allocation is very high due to the long-term controversy between the three states in the ACF Basin. The Corps sought clarification on this issue with Hall County (see Hall County letter in **Appendix L**).

Consistent with the action alternatives, the "No Action Alternative" is based on the following assumptions and conditions:

- Demand projections assume continued implementation of the conservation goals identified in Chapter 1, **Appendix D**, of this EIS.
- The hydrologic modeling of the "No Action Alternative" is based on the same future water demands as the action alternatives (72.5 mgd by the year 2060).
- Water system improvements will continue to be constructed to expand the Gainesville water system throughout the extent of Hall County, except for the areas served by Flowery Branch and Lula.
- Wastewater system improvements will continue to be constructed to expand the services throughout the extent of Hall County with continued effluent discharge to Lake Lanier from Gainesville's WTPs.
- Effluent return to Lake Lanier will not receive "credits" in future storage contract with the Corps and therefore will not provide any additional source of water supply based on the Corps' current policy.

2.6.2.3 Components of the No Action Alternative (L60)

Only those potential water supply source components that do not require Corps authorization of the proposed Glades project were considered as possible components of the "No Action Alternative". Components of the "No Action Alternative" include:

- Additional conservation to reduce water demand (additional demand reduction of 2.3 mgd)
- Additional Lake Lanier allocations to reach a total annual average supply of 60 mgd (current withdrawal level is approximately 18 mgd)
- Cedar Creek Reservoir (4.3 mgd of safe yield - annual average)
- Additional groundwater supply to reach a total of 4.7 mgd
- Water purchase from Jackson County (1.2 mgd)

2.6.2.4 Meeting Future Demand through Additional Lake Lanier Allocation

Lake Lanier serves as the primary water supply source for Hall County and is currently authorized to withdraw 18 mgd on an annual average basis from Lake Lanier. To meet Hall County's projected 2060 water demand without

the construction of a new reservoir would require increasing the total allocation from Lake Lanier to 60 mgd (annual average). The Corps has solicited the Applicant's opinion on what it would do if a permit for the Proposed Project is denied. Hall County stated that it would have no choice but to pursue the highest allocation possible to meet all of its 2060 demand if a permit for the Glades Reservoir is denied.

The Corps Mobile District is currently updating the WCM for the ACF Basin and is evaluating Georgia's January 11, 2013, water supply request for a total of 297 mgd (annual average) from Lake Lanier and a total of 705 mgd (withdrawals from Lake Lanier and below Buford dam) for the metropolitan Atlanta area. It is unknown at this time what portion of the requested 297 mgd may be approved by the Corps Mobile District. It is also unknown what portion of the requested increase in water supply from Lake Lanier that Georgia may decide to allocate to Hall County. Therefore, it is not known whether Hall County's water supply from Lake Lanier may be increased beyond its current withdrawal level (18 mgd annual average), or to the level permitted by EPD (30 mgd monthly average), or to the 60 mgd that would be needed for Hall County to meet its full projected 2060 demand, or possibly some other amount of between 1 and 60 mgd. The inclusion of this component does not mean that Hall County will be granted 60 mgd allocation automatically; rather, this alternative is developed based on what Hall County would need if Glades Reservoir cannot be constructed.

2.6.2.5 Reducing Water Supply Demands through Demand Management/Additional Conservation

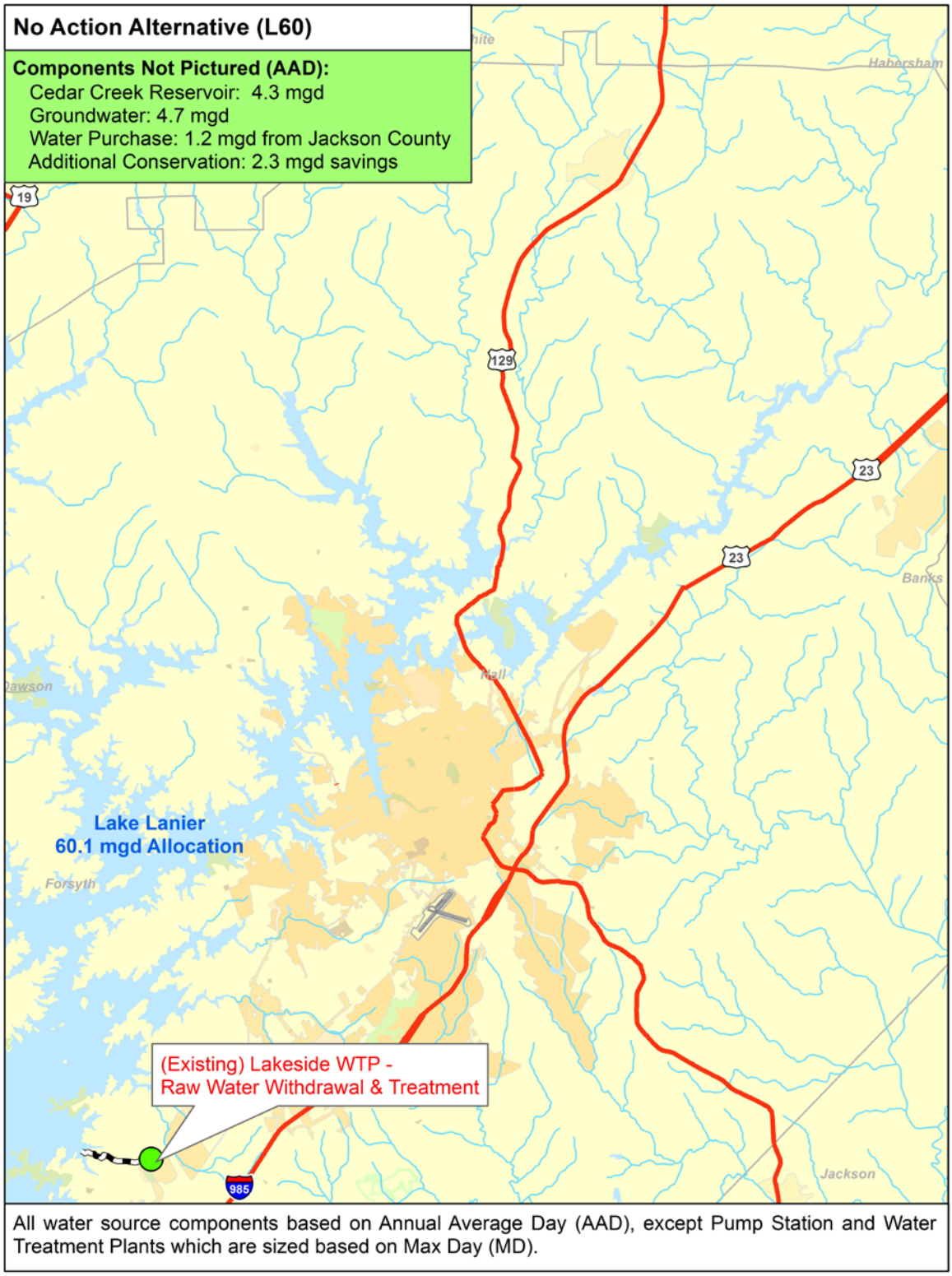
The projected annual average 2060 demand of 72.5 mgd assumes baseline conservation measures to be implemented through continued implementation of the International Plumbing Code of 2006, the MNGWPD conservation requirements, and the Georgia Water Stewardship Act requirements.

An additional conservation scenario was also modeled (Scenario 3), assuming that the NRW will be reduced further to 12.09% by 2025 (equivalent of annual NRW reduction of 0.25% through 2025) and continued implementation of maintenance programs (leak reduction/repair and meter replacement) to maintain a steady NRW at 12.09% through 2060. The DSS Model for the additional conservation scenario shows that an additional water savings of 2.3 mgd could be achieved through these conservation measures.

Achieving further water reduction above this level through additional leak detection and NRW programs may be feasible, but according to data supplied by Gainesville and reviewed by the EIS team; these savings would likely come at very significant costs for low results as the marginal benefits decrease.

The Applicant does not operate the water distribution system in Hall County and is not responsible for water conservation. Water distribution and conservation is the responsibility the City of Gainesville; as well as implementation of additional water conservation programs. Gainesville has an aggressive water conservation program in place, and is currently meeting all state conservation requirements. The Applicant and Gainesville may consider jointly pursuing additional water conservation savings through updating their existing intergovernmental agreement to incorporate water conservation efforts and goals in addition to other operation and maintenance conditions. Figure 2.20 illustrates the components in the No Action Alternative (L60).

Figure 2.20 Components in No Action Alternative (L60)



2.6.3 Formulated Alternatives

All formulated alternatives include the common components below:

- Water Supply from Cedar Creek Reservoir: 4.3 mgd
- Additional Groundwater: a total of 4.7 mgd, including existing permitted groundwater quantity of 3.4 mgd plus development of additional groundwater supplies estimated at 1.3 mgd
- Water Purchase: 1.2 mgd from Jackson County
- Additional Conservation: Estimated savings of 2.3 mgd resulted from proposed implementation of more aggressive water conservation and water loss reduction programs (Conservation Scenario 3, Chapter 1).

2.6.3.1 Summary of Alternatives

Table 2.31 provides a summary of the EIS alternatives. All alternatives considered include the following common components: additional water conservation of 2.3 mgd, water purchase from Jackson County of 1.2 mgd, additional groundwater development in the County for a total of 4.7 mgd, and the use of Cedar Creek Reservoir (revised safe yield of 4.3 mgd). All quantities shown are on annual average basis.

Table 2.31 Summary of Alternatives

Alternative #	Alternative ID	Lake Lanier Allocation (mgd)	Reservoir Site	Reservoir Safe Yield (mgd)	River Water Transmission System (to reservoir)	Reservoir Water Transmission System (to Lakeside WTP)	Reservoir Water Transmission System (to New WTP)
Applicant	L18-G50-PT	18	Glades	50	X		
1	L18-G42-PT	18	Glades	42	X		
2	L18-G42-PL	18		42	X	X	
3	L18-G42-WTP	18		42	X		X
4	L30-G30-PT	30		30	X		
5	L30-G30-PL	30		30	X	X	
6	L30-G30-WTP	30		30	X		X
7	L43-G17-PT	43		17	X		
8	L43-G17-PL	43		17	X	X	
9	L43-G17-WTP	43		17	X		
10	L43-W17-PT	43	White	17	X		
11	L43-W17-PL	43		17	X	X	
No Action	L60	60	None				

Alternative Key:
G = Glades Reservoir; W= White Creek Reservoir
42/30/17 = Reservoir safe yield = 42/30/17 mgd

L= Lake Lanier, the number following L indicates potential total water supply allocation for Hall County, for example, L30 = a total of 30 mgd for annual average water supply withdrawal from Lake Lanier

18/30/43/60 = total annual average water supply withdrawal from Lake Lanier

PT = Release raw water to creek and "pass-through" flows to Lake Lanier for withdrawal
PL = Pump/pipeline for raw water from reservoir to Lakeside WTP
WTP = Construct new WTP at Glades Reservoir site

2.6.3.2 Alternative 1 (L18-G42-PT)

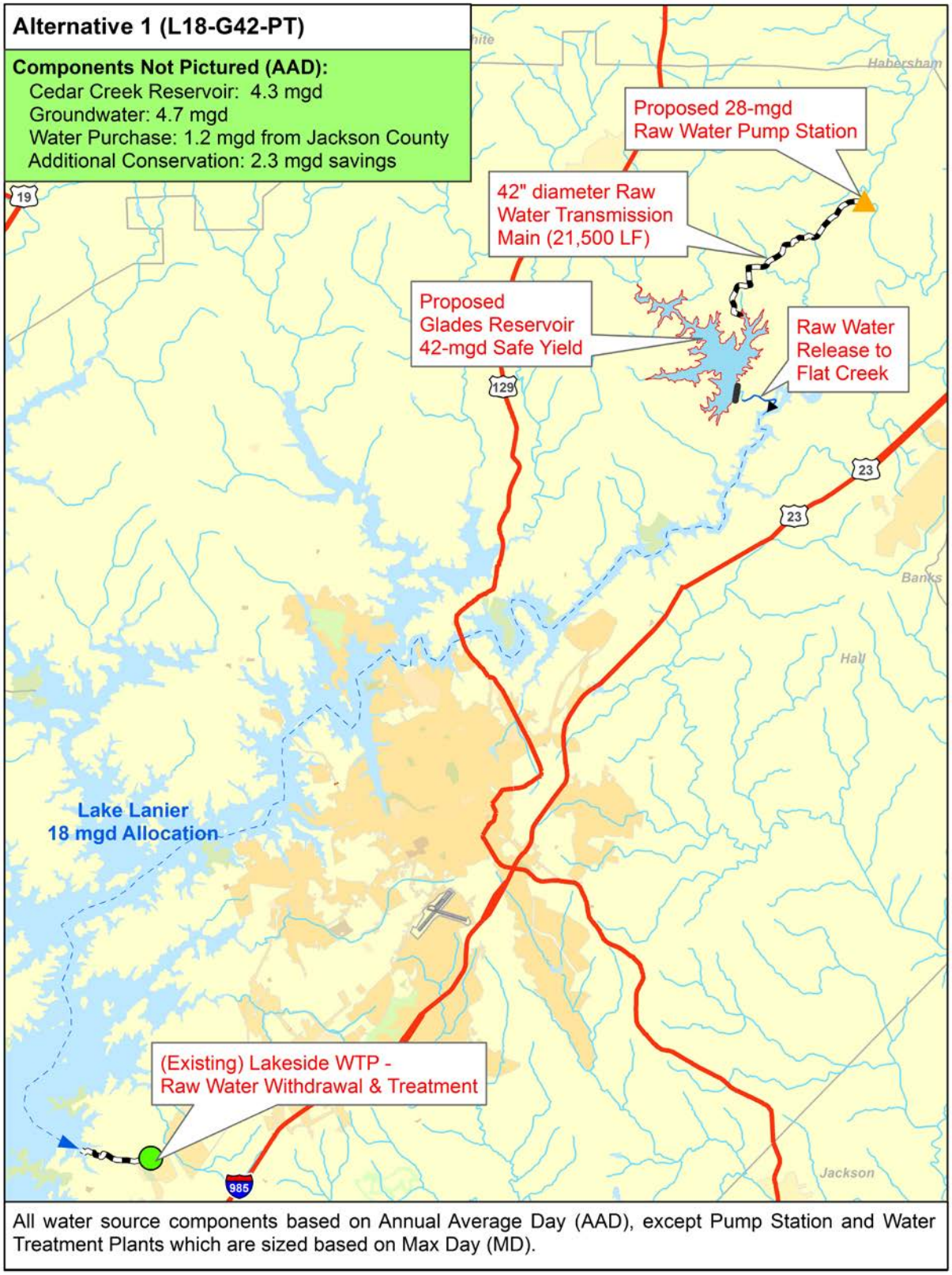
Alternative 1 (L18-G42-PT) assumes an 18-mgd allocation from Lake Lanier, and combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. An overview of Alternative 1 (L18-G42-PT) is included in **Table 2.32** and **Figure 2.21**.

Table 2.32 Construction Elements in Alternative 1 (L18-G42-PT)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 42 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (four 600-HP pumps) with firm capacity (maximum day) of 28 mgd
	21,500-feet, 42-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing maximum daily quantity of 63 mgd Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Release to Lake Lanier via Flat Creek/Chattahoochee River and treat at Lakeside WTP

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.21 Project Elements in Alternative 1 (L18-G42-PT)



2.6.3.3 Alternative 2 (L18-G42-PL)

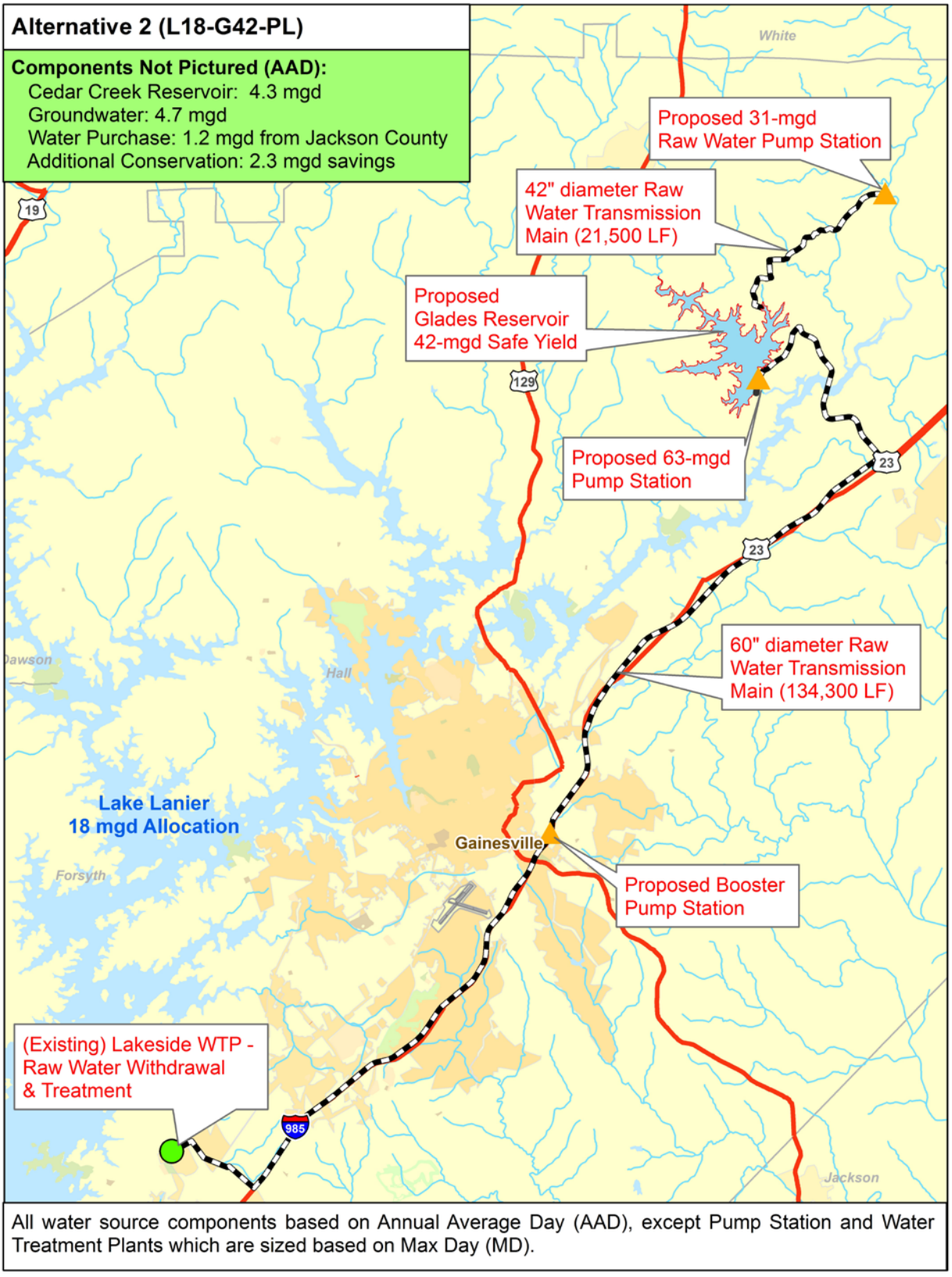
Alternative 2 (L18-G42-PL) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 1 (L18-G42-PT) and Alternative 2 (L18-G42-PL) is the transmission mechanism between the proposed reservoir and Lakeside WTP. For this alternative, a pump station will be constructed at Glades Reservoir and a 135,000-linear foot raw water transmission main will be constructed between the pump station and the plant. An overview of Alternative 2 (L18-G42-PL) is included in **Table 2.33** and **Figure 2.22**. This Alternative assumes an 18 mgd allocation from Lake Lanier.

Table 2.33 Construction Elements in Alternative 2 (L18-G42-PL)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 42 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (four 700-HP pumps) with firm capacity (maximum day) of 31 mgd
	21,500-feet, 42-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4-BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (3 mgd) into Flat Creek
	Land acquisition: One parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Reservoir intake and pump station with max day firm capacity of 63 mgd (four 700-HP pumps)
	Booster Pump Station with max day firm capacity of 63 mgd (four 500-HP pumps)
	134,300-foot 60-inch diameter DIP from reservoir to the Lakeside WTP
	Land acquisition: easement for 25.4 miles of pipeline; land for pump station

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.22 Project Elements in Alternative 2 (L18-G42-PL)



2.6.3.4 Alternative 3 (L18-G42-WTP)

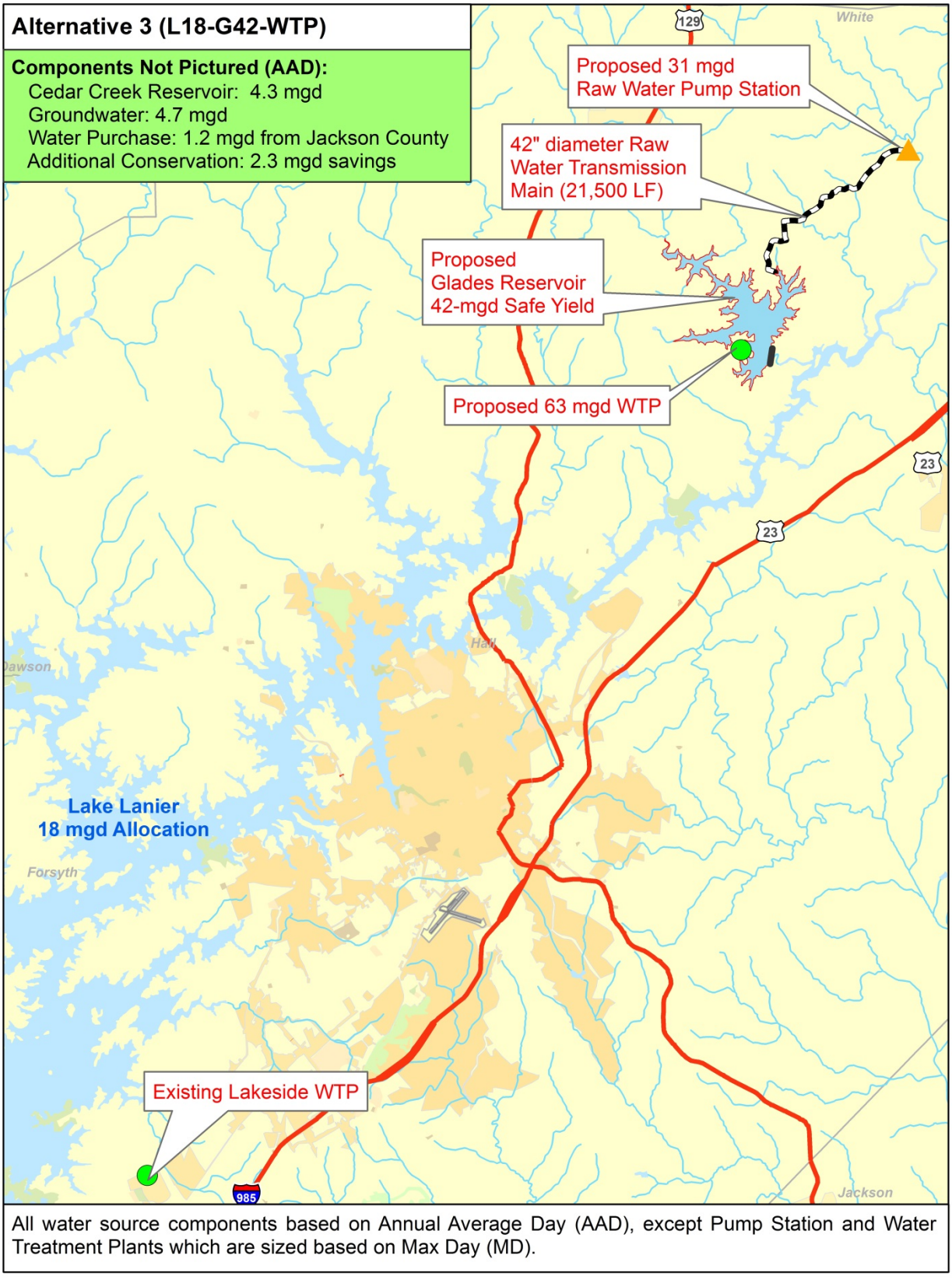
Alternative 3 (L18-G42-WTP) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 1 (L18-G42-PT) and Alternative 3 (L18-G42-WTP) is the transmission and treatment mechanism for the raw water. For this alternative, a pump station and new WTP will be constructed at Glades Reservoir. An overview of Alternative 3 (L18-G42-WTP) is included in **Table 2.34** and **Figure 2.23**. This Alternative assumes an 18 mgd allocation from Lake Lanier.

Table 2.34 Construction Elements in Alternative 3 (L18-G42-WTP)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 42 mgd
River Water and Transmission (to Reservoir)	Chattahoochee River RWPS (four 700-HP pumps) with firm capacity (maximum day) of 31 mgd
	21,500-feet, 42-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (3 mgd) into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to New WTP)	Reservoir PS 63-mgd max day capacity (four 350-HP pumps)
	600-feet, 60-inch diameter DIP from reservoir to new WTP
	New 63-mgd WTP, located adjacent to reservoir

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.23 Project Elements in Alternative 3 (L18-G42-WTP)



2.6.3.5 Alternative 4 (L30-G30-PT)

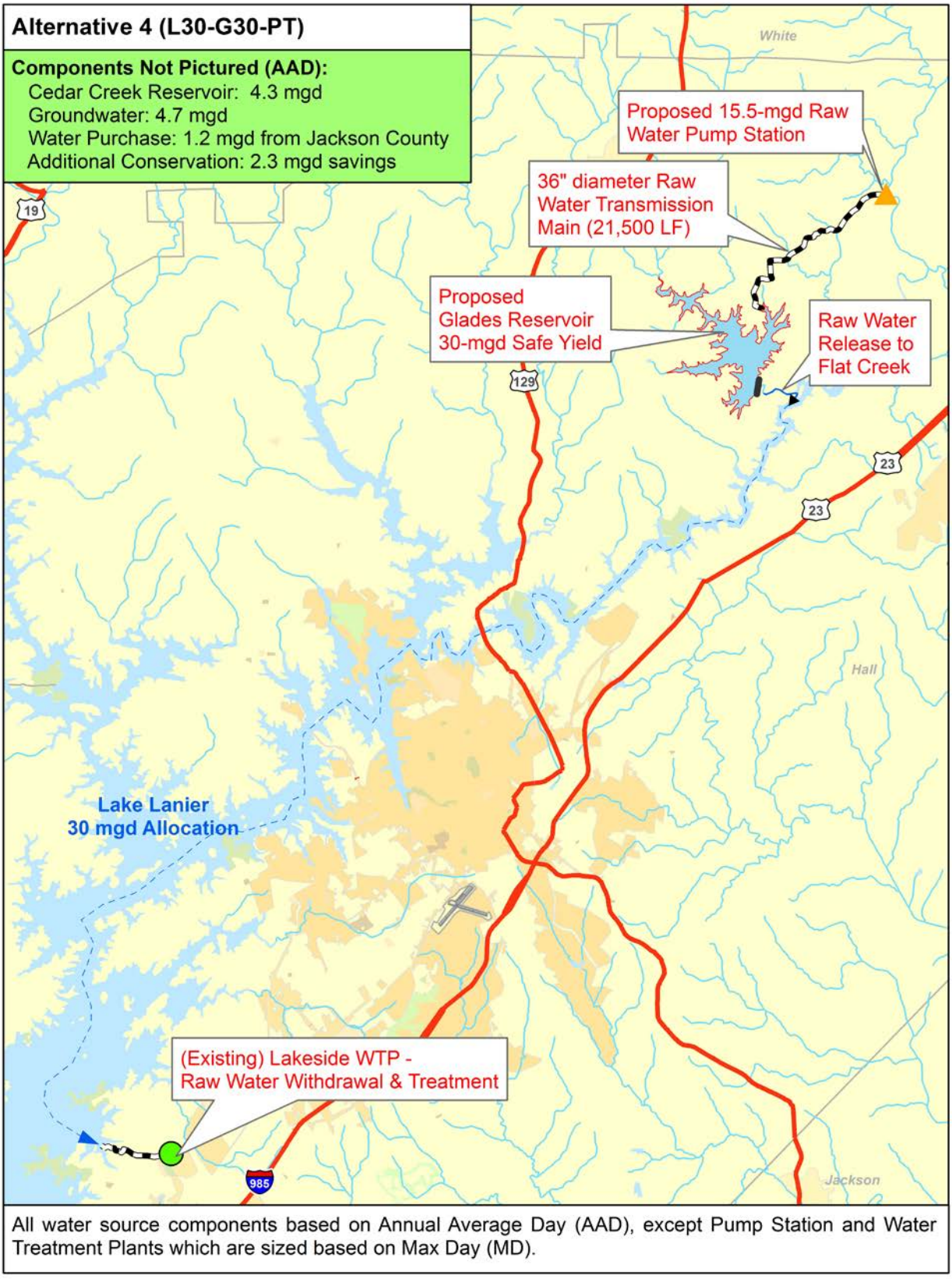
Alternative 4 (L30-G30-PT) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 1 (L18-G42-PT) and Alternative 4 (L30-G30-PT) is the water allocation from Lake Lanier. For this alternative, a total of 30 mgd of storage allocation is assumed from Lake Lanier, thus the water supply from the proposed Glades Reservoir can be reduced. An overview of Alternative 4 (L30-G30-PT) is included in **Table 2.35** and **Figure 2.24**.

Table 2.35 Construction Elements in Alternative 4 (L30-G30-PT)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 30 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (four 350-HP pumps) with firm capacity (maximum day) of 15.5 mgd
	21,500-feet, 36-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land Acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing maximum daily quantity of 45 mgd into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Release to Lake Lanier via Flat Creek/Chattahoochee River and treat at Lakeside WTP

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.24 Project Elements in Alternative 4 (L30-G30-PT)



2.6.3.6 Alternative 5 (L30-G30-PL)

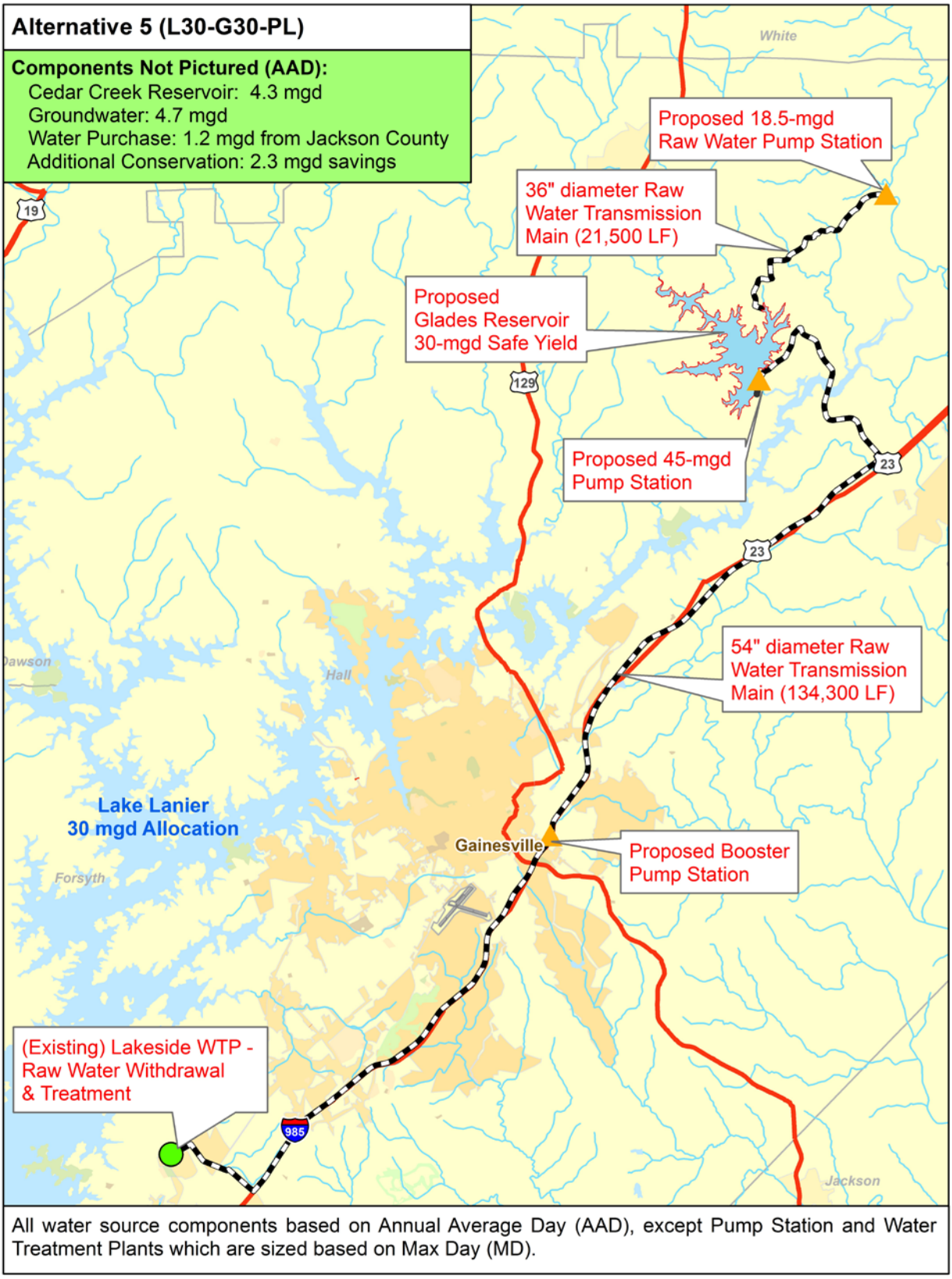
Alternative 5 (L30-G30-PL) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 4 (L30-G30-PT) and Alternative 5 (L30-G30-PL) is proposed conveyance mechanism from the raw water from reservoir to treatment plant. For this alternative, a new pump station will be constructed at the reservoir and a raw water pipeline to convey water to the existing Lakeside WTP. An overview of Alternative 5 (L30-G30-PL) is included in **Table 2.36** and **Figure 2.25**.

Table 2.36 Construction Elements in Alternative 5 (L30-G30-PL)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 30 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (four 400-HP pumps) with firm capacity (maximum day) of 18.5 mgd
	21,500-feet, 36-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (3 mgd) into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Reservoir intake and pump station with max day firm capacity 45 mgd, (four 500-HP pumps)
	Booster Pump Station (four 350-HP pumps)
	134,300-foot 54-inch diameter DIP from reservoir to the Lakeside WTP
	Land acquisition: easement for 25.4 mile of pipeline; land for pump station

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.25 Project Elements in Alternative 5 (L30-G30-PL)



2.6.3.7 Alternative 6 (L30-G30-WTP)

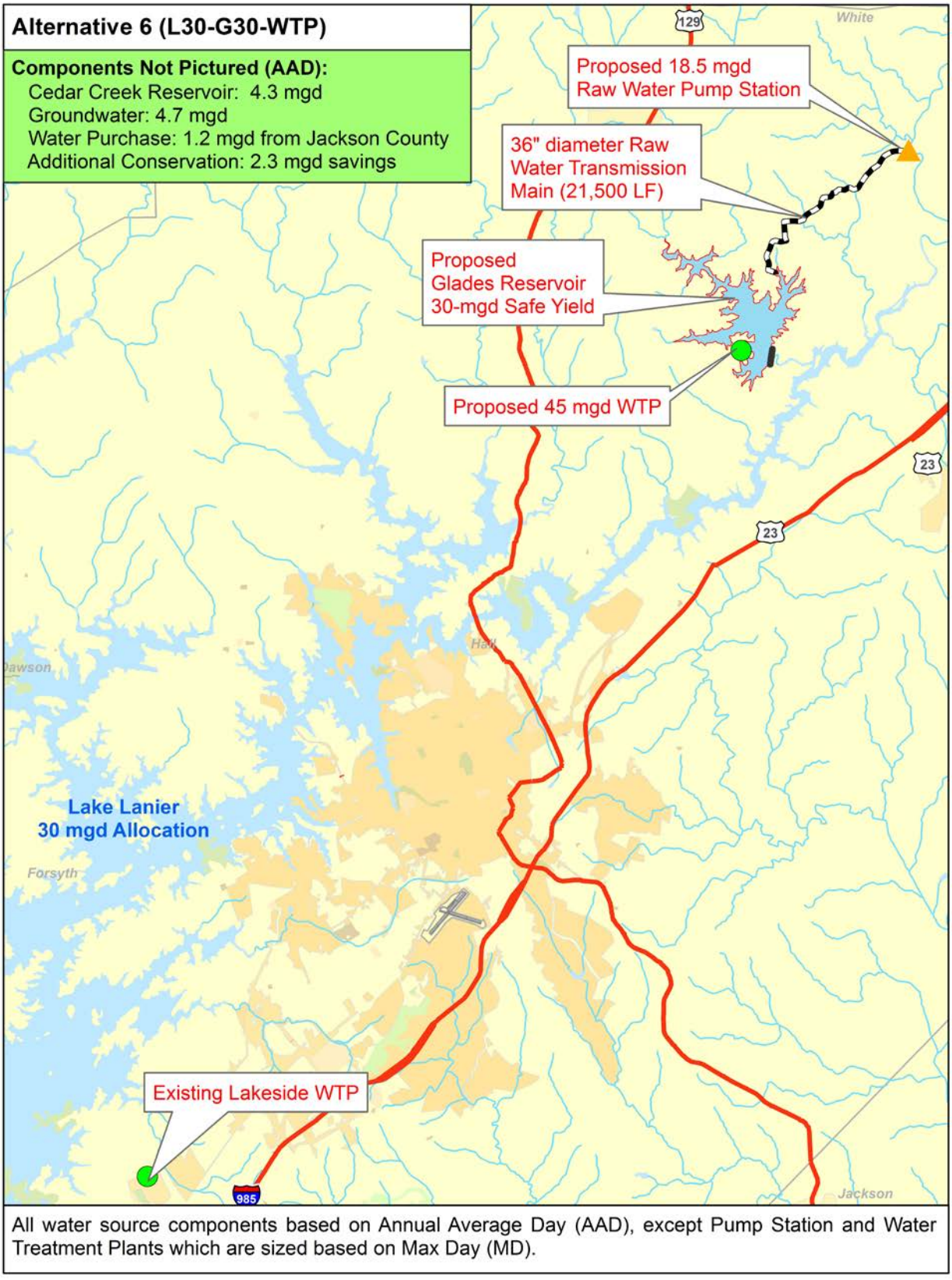
Alternative 6 (L30-G30-WTP) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 4 (L30-G30-PT) and Alternative 6 (L30-G30-WTP) is proposed treatment mechanism for raw water. For this alternative, a new WTP will be constructed at the site of the proposed reservoir. An overview of Alternative 6 (L30-G30-WTP) is included in **Table 2.37** and **Figure 2.26**.

Table 2.37 Construction Elements in Alternative 6 (L30-G30-WTP)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 30 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (four 400-HP pumps) with firm capacity (maximum day) of 18.5 mgd
	21,500-feet, 36-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (3 mgd) into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to New WTP)	Reservoir PS 45-mgd (max day capacity) (four 250-HP pumps)
	600-feet, 54-inch diameter DIP from reservoir to new WTP
	New 45-mgd WTP located adjacent to reservoir Land acquisition: 42 acres for PS and new WTP

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.26 Project Elements in Alternative 6 (L30-G30-WTP)



2.6.3.8 Alternative 7 (L43-G17-PT)

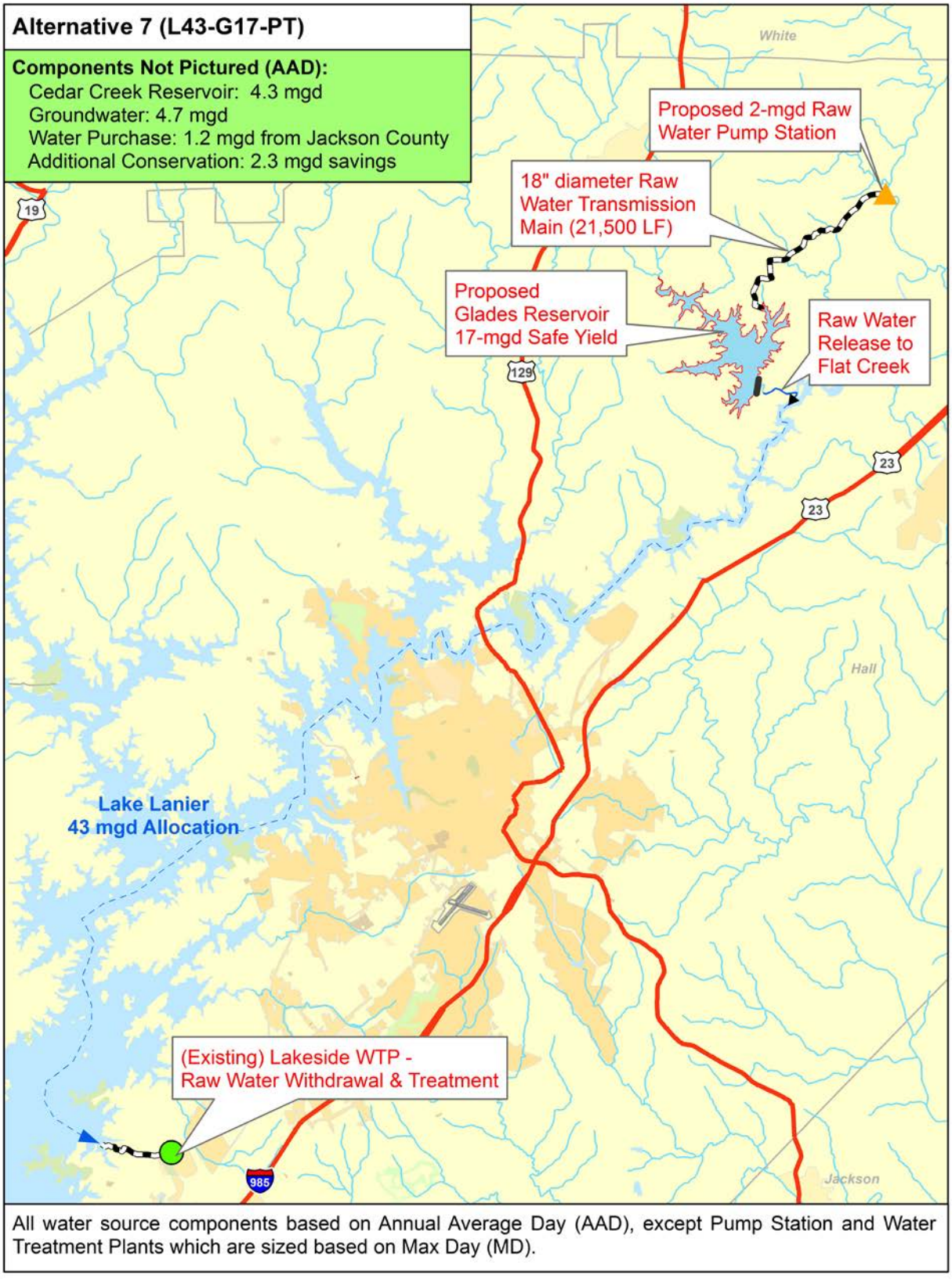
Alternative 7 (L43-G17-PT) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 1 (L18-G42-PT) and Alternative 7 (L43-G17-PT) is the water allocation from Lake Lanier. For this alternative 43 mgd (25 mgd additional allocation is assumed from Lake Lanier, thus the water supply from the proposed Glades Reservoir can be reduced. An overview of Alternative 7 (L43-G17-PT) is included in **Table 2.38** and **Figure 2.27**.

Table 2.38 Construction Elements in Alternative 7 (L43-G17-PT)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 17 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (three 100-HP pumps) with firm capacity (maximum day) of 2 mgd
	21,500-feet, 18-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam; height: 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing maximum daily quantity of 26 mgd into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Release to Lake Lanier via Flat Creek/Chattahoochee River and treat at Lakeside WTP

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.27 Project Elements in Alternative 7 (L43-G17-PT)



2.6.3.9 Alternative 8 (L43-G17-PL)

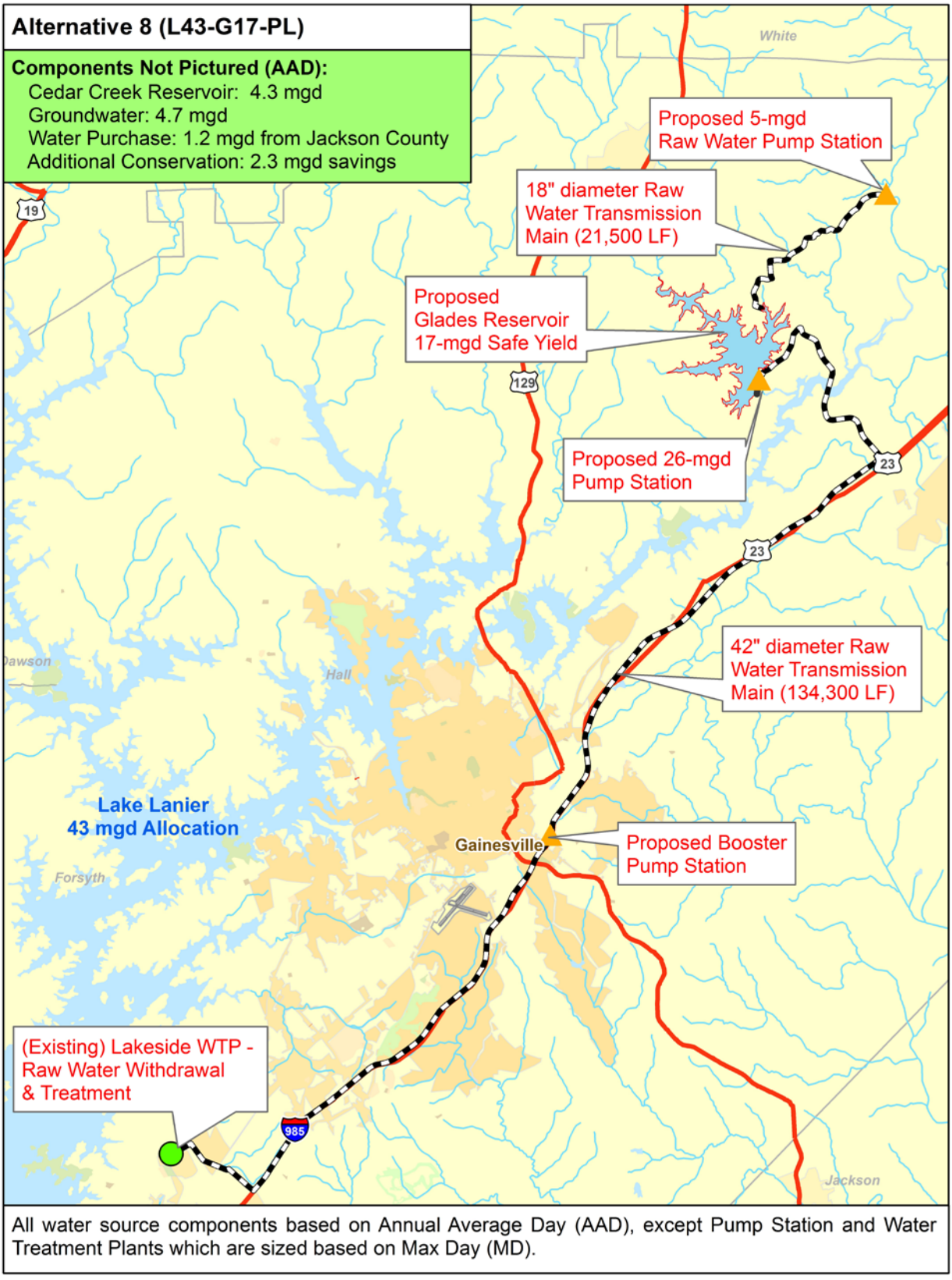
Alternative 8 (L43-G17-PL) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 7 (L43-G17-PT) and Alternative 8 (L43-G17-PL) is the raw water transmission mechanism. For this alternative, a raw water pipeline will be constructed between the proposed Glades Reservoir and the Lakeside WTP. An overview of Alternative 8 (L43-G17-PL) is included in **Table 2.39** and **Figure 2.28**.

Table 2.39 Construction Elements in Alternative 8 (L43-G17-PL)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 17 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (three 200-HP pumps) with firm capacity (maximum day) of 5 mgd
	21,500-feet, 18-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam: height; 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (3 mgd) into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to Lakeside WTP)	Reservoir Intake and Pump Station with max day firm capacity 26 mgd, (four 300-HP pumps)
	Booster Pump Station (three 200-HP pumps)
	134,300-foot 42-inch diameter DIP from reservoir to the Lakeside WTP
	Land acquisition: easement for 25.4 mile of pipeline; land for pump station

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.28 Project Elements in Alternative 8 (L43-G17-PL)



2.6.3.10 Alternative 9 (L43-G17-WTP)

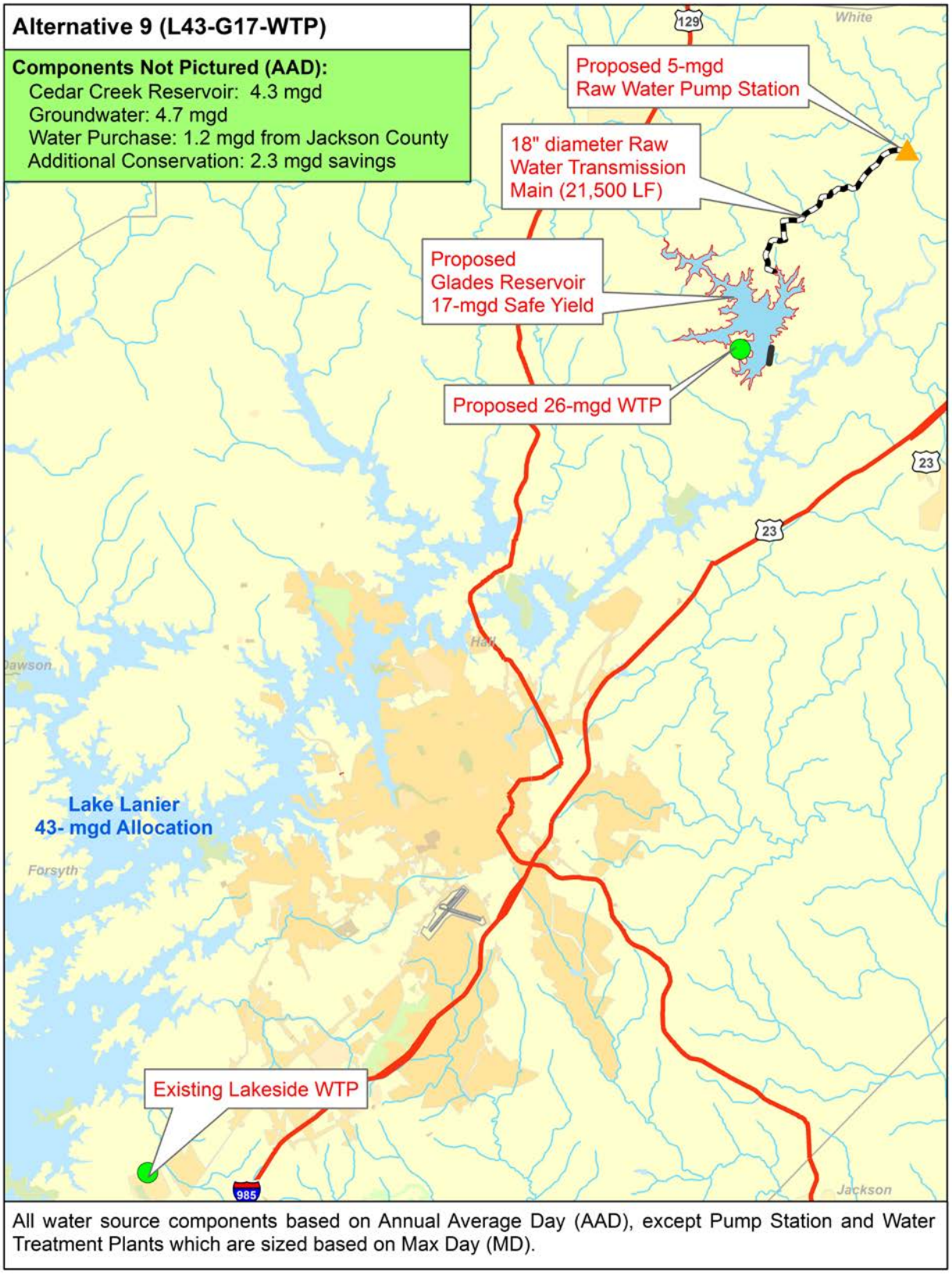
Alternative 9 (L43-G17-WTP) combines Glades Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. For Alternative 9 (L43-G17-WTP), a new WTP would be constructed adjacent to the reservoir. Water would be pumped from the reservoir for a short distance for treatment at the new WTP prior to distribution. An overview of Alternative 9 (L43-G17-WTP) is included in **Table 2.40** and **Figure 2.29**.

Table 2.40 Construction Elements in Alternative 9 (L43-G17-WTP)

New Reservoir	New pumped-storage reservoir: Glades Reservoir - AAD safe yield of 17 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (three 200-HP pumps) with firm capacity (maximum day) of 5 mgd
	21,500-feet, 18-inch diameter DIP from Chattahoochee River RWPS to the Glades Reservoir
	Land acquisition: easement for 21,500 feet of pipeline; land for pump station
Reservoir	36,000 acre-feet new storage volume (with 9.4 BG of usable storage volume)
	Earthfill dam: height; 140 feet; crest length: 1,400 feet
	Realignment and bridging of Glade Farm Road (16,000 LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (3 mgd) into Flat Creek
	Land acquisition: one parcel (owned by Applicant)
Reservoir Water Transmission (to New WTP)	Reservoir Intake and Pump Station with max day firm capacity 26 mgd
	600-foot 42-inch diameter DIP from reservoir to the new WTP
	Construction of a new 26-mgd (max day) WTP
	Land acquisition: easement for 600-feet pipeline; land for reservoir pump station and WTP (25 acres)

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.29 Project Elements in Alternative 9 (L43-G17-WTP)



2.6.3.11 Alternative 10 (L43-W17-PT)

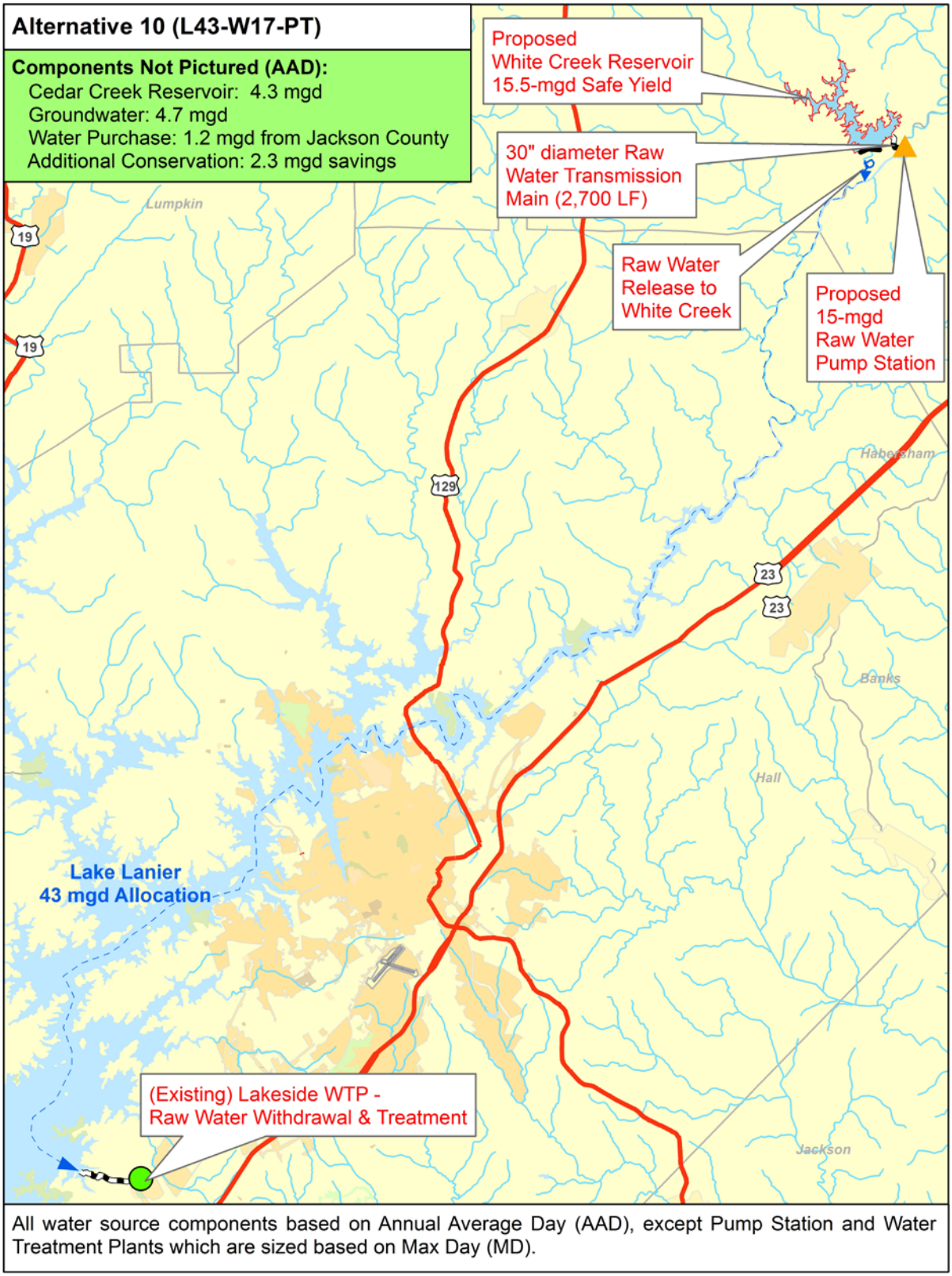
Alternative 10 (L43-W17-PT) combines White Creek Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 7 (L43-G17-PT) and Alternative 10 (L43-W17-PT) is the proposed reservoir site. For this alternative, the White Creek Reservoir site will be utilized. An overview of Alternative 10 (L43-W17-PT) is included in **Table 2.41** and **Figure 2.30**.

Table 2.41 Construction Elements in Alternative 10 (L43-W17-PT)

New Reservoir	New pumped-storage reservoir: White Creek Reservoir - AAD safe yield of 17 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (three 300-HP pumps) with firm capacity (maximum day) of 15.5 mgd
	2,700-feet, 30-inch diameter DIP from Chattahoochee River RWPS to the White Creek Reservoir
	Land acquisition: easement for 2,700-feet of pipeline; land for pump station
Reservoir	12,000 acre-feet new storage volume (with 3.1-BG of usable storage volume)
	Earthfill dam; height: 160 feet; crest length: 1,700 feet
	Realignment and bridging of Webster Bridge Road (3680-LF road + 560-LF bridge) Realignment of Orion Road (1050-LF) Realignment and bridging of New Bridge Road (420-LF road + 440-LF bridge) Realignment of Little Rock Road (2260-LF) Realignment of Gospel Park Drive (760-LF) Realignment of Private Road Off Webster (470-LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing maximum daily quantity of 26 mgd into White Creek
	Land acquisition: 72 Parcels
Reservoir Water Transmission (to Lakeside WTP)	Release to Lake Lanier via White Creek/Chattahoochee River and treat at Lakeside WTP

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.30 Project Elements in Alternative 10 (L43-W17-PT)



2.6.3.12 Alternative 11 (L43-W17-PL)

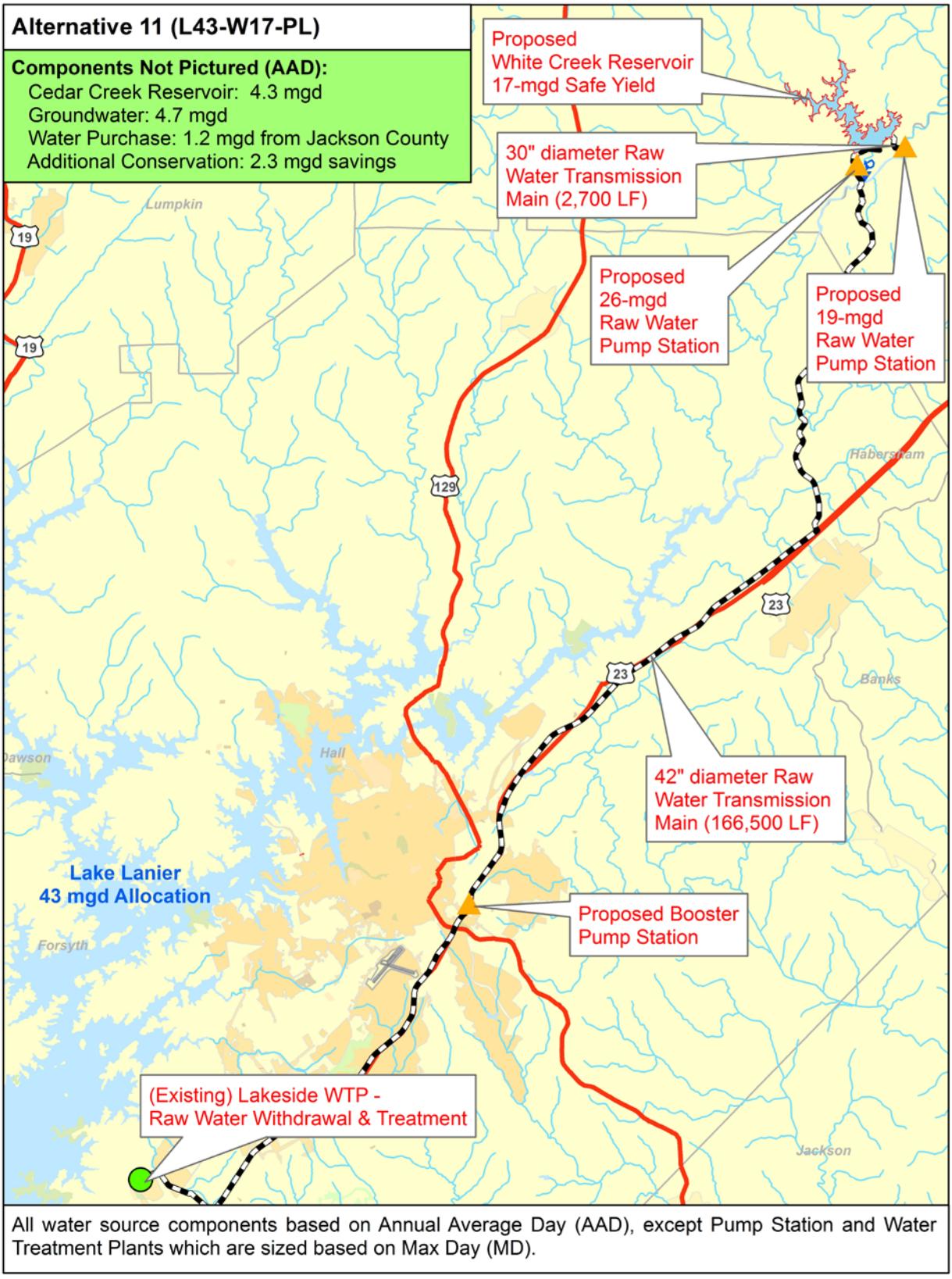
Alternative 11 (L43-W17-PL) combines White Creek Reservoir as a new water supply source with other water source components to supply the unmet need for Hall County. The difference between Alternative 10 (L43-W17-PT) and Alternative 11 (L43-W17-PL) is the proposed transmission mechanism for raw water. For this alternative, a proposed raw water pipeline will be constructed between the proposed reservoir and the existing Lakeside WTP. An overview of Alternative 11 (L43-W17-PL) is included in **Table 2.42** and **Figure 2.31**.

Table 2.42 Construction Elements in Alternative 11 (L43-W17-PL)

New Reservoir	New pumped-storage reservoir: White Creek Reservoir - AAD safe yield of 17 mgd
River Water Transmission (to Reservoir)	Chattahoochee River RWPS (three 400-HP pumps) with firm capacity (maximum day) of 19 mgd
	2,700-feet, 30-inch diameter DIP from Chattahoochee River RWPS to the White Creek Reservoir
	Land acquisition: easement for 2,700-feet of pipeline; land for pump station
Reservoir	12,000 acre-feet new storage volume (with 3.1-BG of usable storage volume)
	Earthfill dam; height: 160 feet; crest length: 1,700 feet
	Realignment and bridging of Webster Bridge Road (3680-LF road + 560-LF bridge) Realignment of Orion Road (1050-LF) Realignment and bridging of New Bridge Road (420-LF road + 440-LF bridge) Realignment of Little Rock Road (2260-LF) Realignment of Gospel Park Drive (760-LF) Realignment of Private Road Off Webster (470-LF)
	All borrow material from reservoir pool area
	Concrete outlet pipe for releasing minimum instream flow (1.7 mgd) into White Creek
	Land acquisition: 72 Parcels
Reservoir Water Transmission (to Lakeside WTP)	Reservoir Intake and Pump Station (max day firm capacity 26 mgd, (four 500-HP pumps)
	Booster Pump Station (four 200-HP pumps)
	166,500-feet 42-inch diameter DIP from reservoir to the Lakeside WTP
	Land acquisition: easement for 31.5 miles of pipeline; land for pump station

Notes:
RWPS = raw water pump station
Firm capacity is the maximum daily capacity available with one of the largest pumps out of service.
Maximum daily demand is based on the average daily demand x a peaking factor of 1.5

Figure 2.31 Project Elements in Alternative 11 (L43-W17-PL)



2.7 EIS Alternatives Preliminary Engineering: Construction Logistics

Preliminary engineering and evaluation of construction logistics (construction schedule and sequencing) is needed to determine the permanent and temporary nature of the impacts associated with the construction of each alternative. This section discusses construction logistics and timing that is important in determining the impacts of the Proposed Project and the alternatives carried forward for further evaluation.

2.7.1 Construction Schedule, Sequencing, and Permit Conditions

Construction of the project facilities would occur year-round. The estimated construction period varies for each of the alternatives from approximately 9 - 24 years, depending on whether the construction of the water supply components can be phased. Because the alternatives considered are based on the assumption that the Applicant may ultimately receive different storage allocation from Lake Lanier, the timing for construction for various built elements (mainly the reservoir, the raw water transmission system from the river, and the raw water transmission system from the reservoir to the WTP) will vary depending on when the available water supplies from sources such as Lake Lanier and the Cedar Creek Reservoir may be close to be exhausted.

The following steps describe how a conceptual construction schedule and sequence for each alternative are determined:

1. Estimate the latest timeline when the proposed reservoir is required to be online based on a comparison of projected demand and available supplies from existing sources and new sources with minimal environmental impacts (such as additional water conservation, water purchase, and groundwater development).
2. Determine when the river water transmission system (from the Chattahoochee River to the reservoir) is required to be online, assuming that the reservoir will operate initially with natural drainage from the watershed only until additional yield is needed.
3. Assume that the transmission system from the reservoir to the WTP (Lakeside or new WTP) needs to be online when the reservoir is in operation so the water from the reservoir can be transported to its treatment locations.
4. Estimate the start time for design and construction based on time required for design and construction of the major water supply component.

A series of figures (**Figure 2.32 to Figure 2.37**) were developed for each group of alternatives based on the Lake Lanier allocation quantity for determination of the “latest time the water supply component/infrastructure should be online”. A typical construction sequence is shown for various water supply components in **Table 2.43**. **Table 2.44** is a brief summary of estimated time required for the design and construction of the major water supply components. As shown in the table, the total years required include local permitting, land acquisition, funding, design and construction, and other applicable element (such as filling of reservoir) prior to a component can be completed and in operation. The figures and table are then used to develop a construction schedule (**Figure 2.38**).

Figure 2.32 Applicant's Proposed Project Demand and Supply Comparison

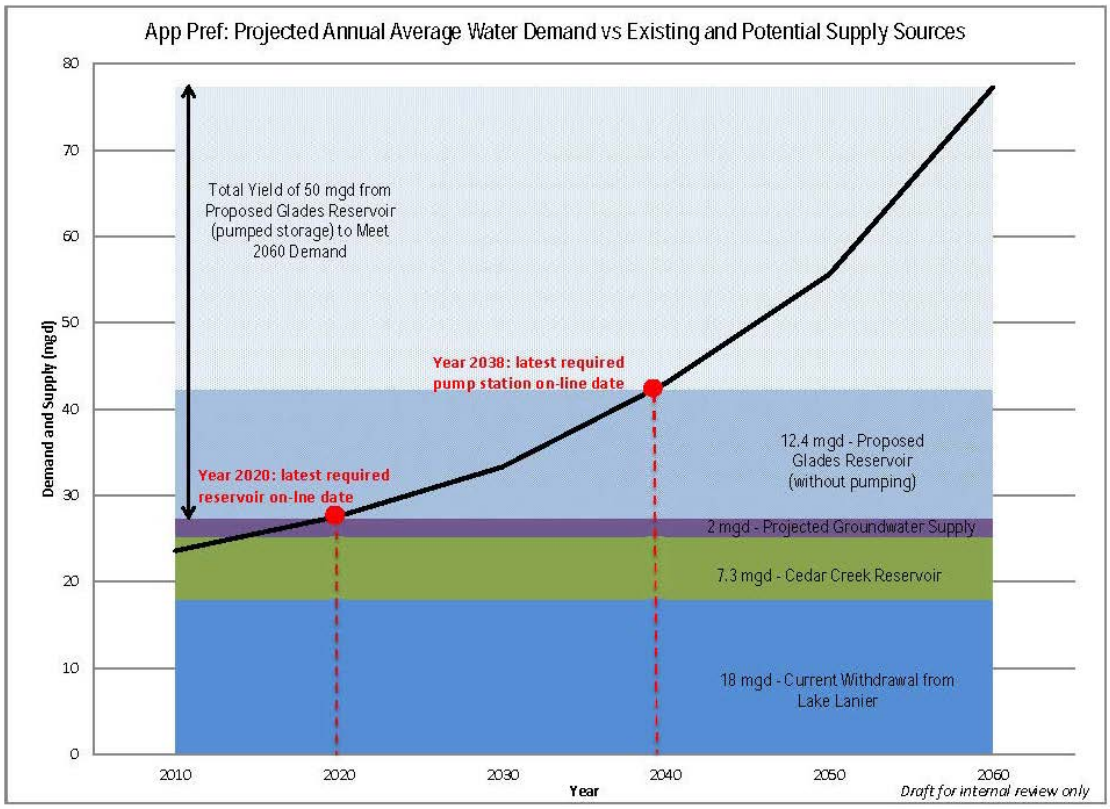


Figure 2.33 Alternative 1 – Demand and Supply Comparison

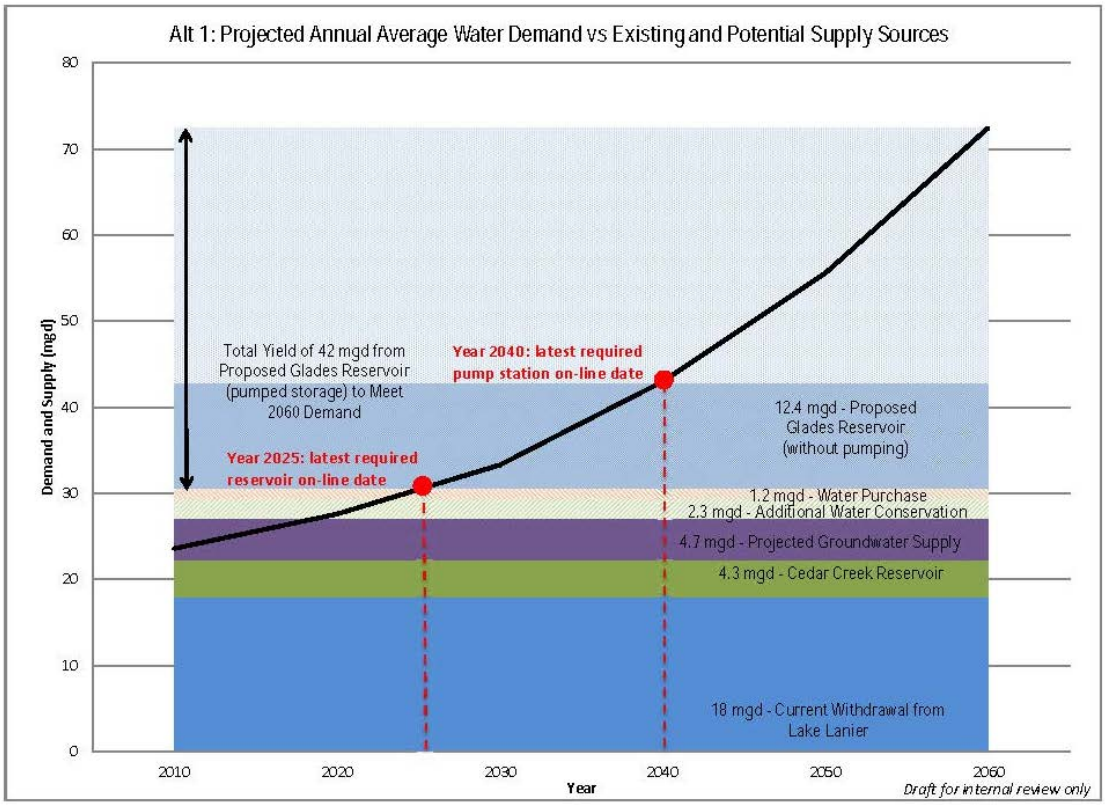


Figure 2.34 Alternative 2 – Demand and Supply Comparison

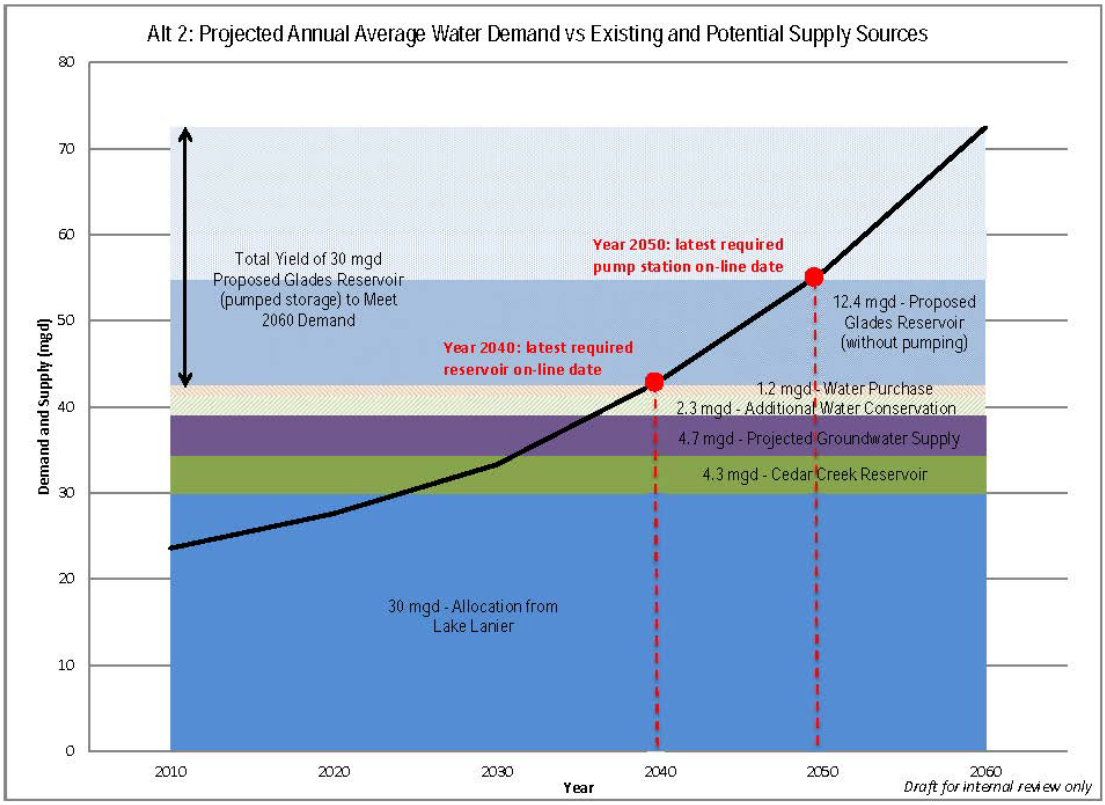


Figure 2.35 Alternative 3 – Demand and Supply Comparison

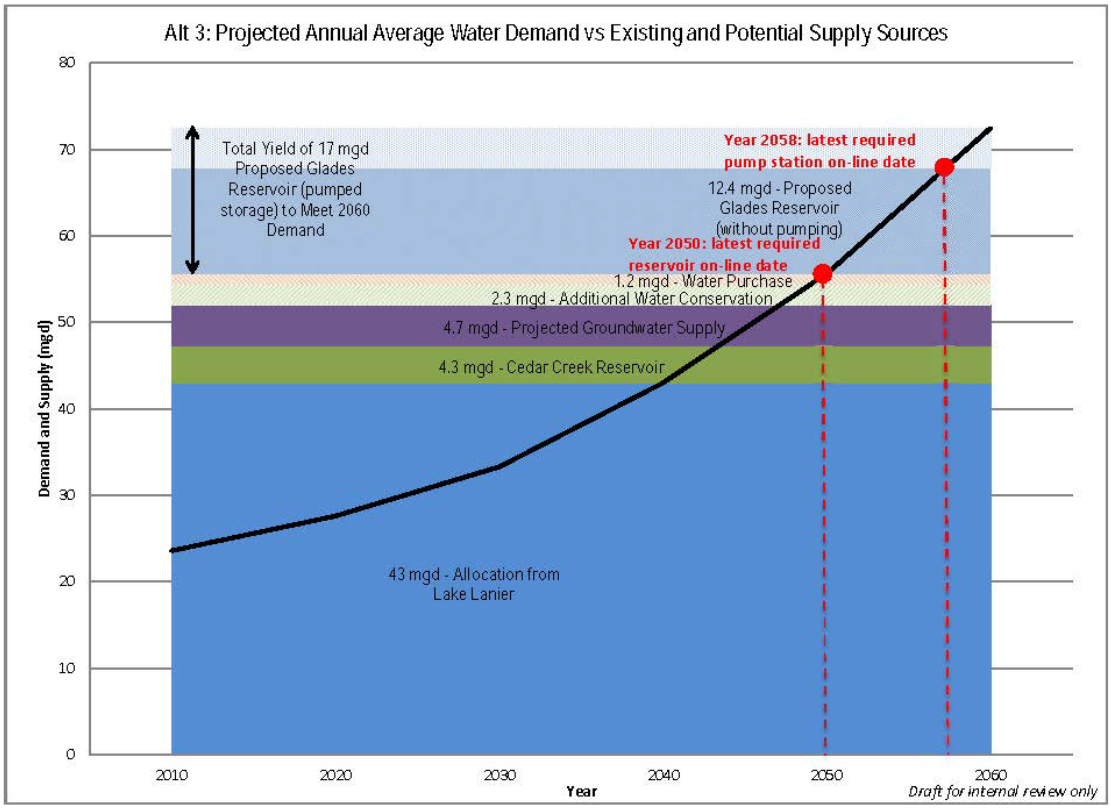


Figure 2.36 Variation of Alternative 3 (L43-W17-PT with White Creek Reservoir) - Demand and Supply Comparison

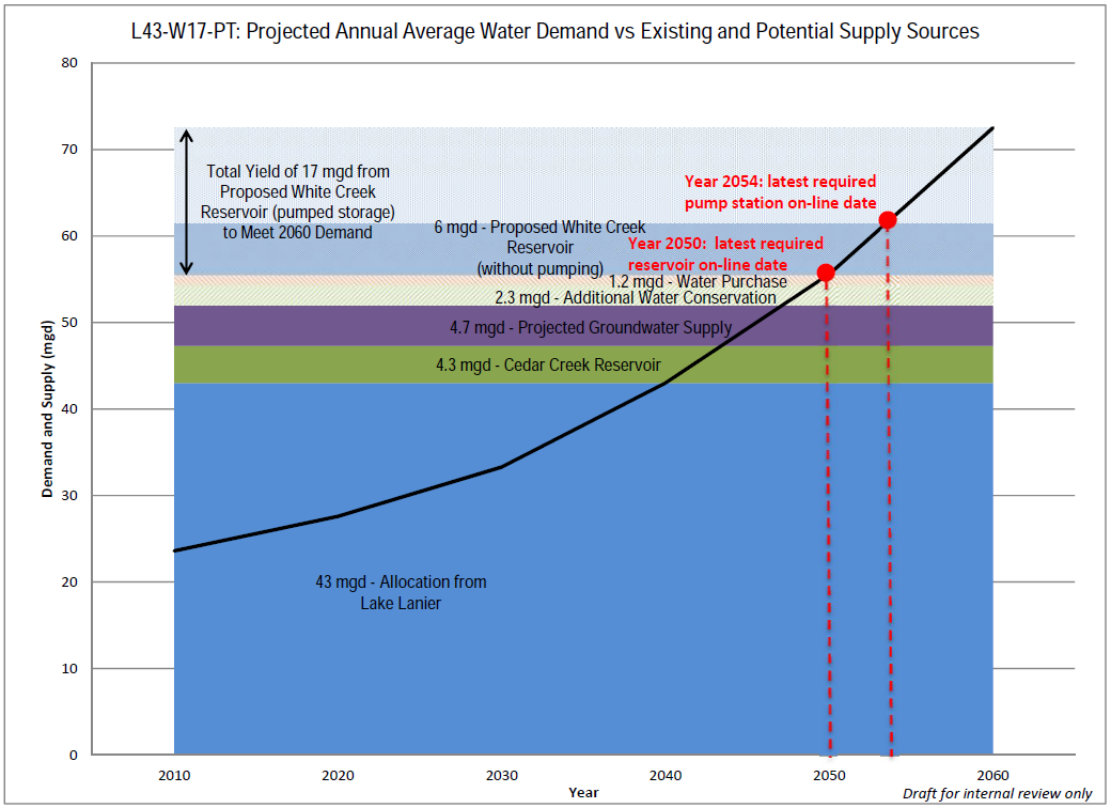


Figure 2.37 Alternative 4 – Demand and Supply Comparison

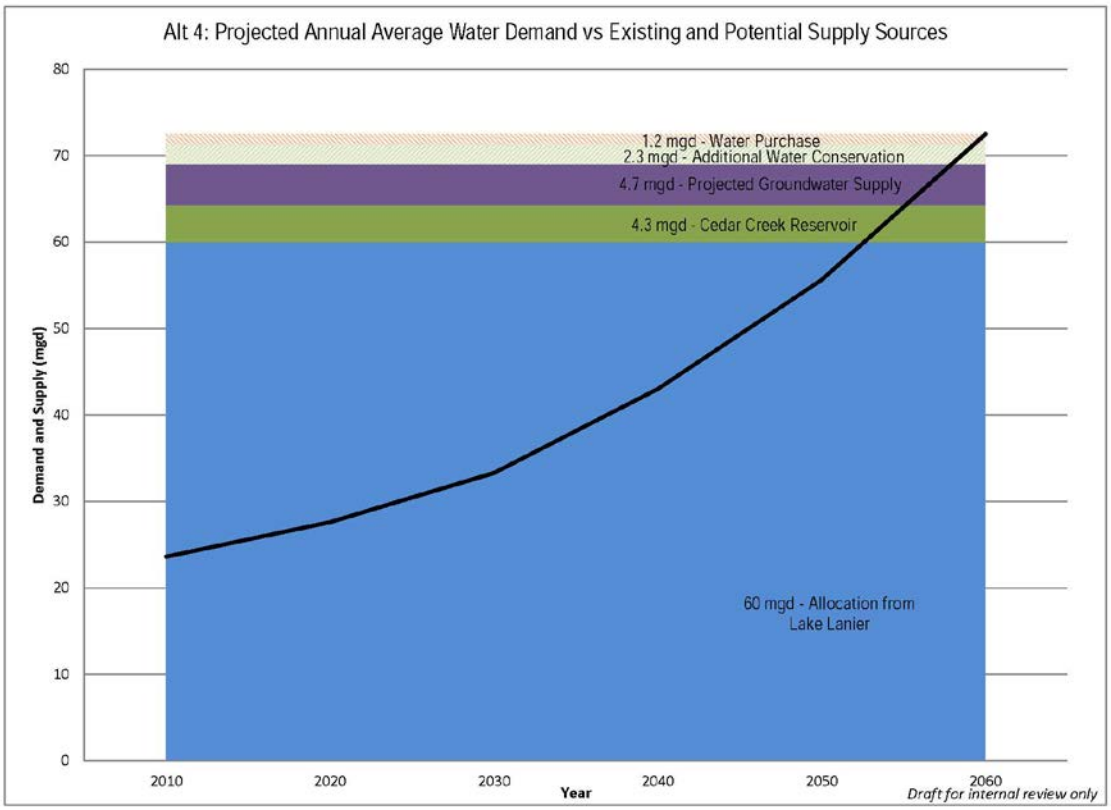


Table 2.43 Typical Construction Sequences

New Reservoir Construction: Mobilization Clearing and grubbing Outlet works Excavation Foundation treatment Embankment construction Access roads Spillway construction Slope protection Demobilization	New Pump Stations: Mobilization Clearing and grubbing Access road Excavation Concrete placement Piping and below-grade utilities installation Above-grade structure construction Mechanical and electrical equipment installation Controls system installation Landscaping Demobilization
Pipelines Mobilization Rights-of-way clearing and grubbing Pipe stringing Trenching Pipe installation Inspection and protective wrapping Backfill, repave/re-grade Re-vegetate (if applicable) Hydrotest and commission Demobilization	New WTP: Mobilization Clearing and grubbing Access road Excavation Concrete placement Piping and below-grade utilities installation Above-grade process structure construction Mechanical and electrical equipment installation Controls system installation Demobilization

Construction Timing and Special Permit Conditions

The City of Gainesville is currently allowed to withdraw a maximum of 18 mgd from Lake Lanier, for use in Hall County. The alternatives considered in this DEIS are based on a variable assumption that: (1) Gainesville may be allowed to withdraw all of the additional water from Lake Lanier that Hall County would be needed to meet the 50-year projected demand; (2) they may be allowed to withdraw an undetermined additional volume of water from Lake Lanier to meet a portion of the projected demand; or (3) the they may not be allowed to withdraw any additional water from Lake Lanier.

In addition to the potential for additional water supply from Lake Lanier, there is an existing untapped supply of water available in Cedar Creek Reservoir; as well as the potential for additional supply from ground water, water purchase and additional conservation. Considering these variables, the Corps cannot predict exactly when the county might need the water that would be provided by the construction of a new water supply reservoir. However, based on all available information regarding Hall County's available water supplies, it is reasonable for the Corps to assume that the county will not need to construct a water supply reservoir for at least fifteen to twenty years.

Furthermore, if a water supply reservoir is needed in the future, the components of such a project could be phased to incrementally meet increasing demand. As proposed, Glades Reservoir would provide a reliable yield of approximately 13 mgd, based solely on inflow from Flat Creek. Construction of a pumping station and water transmission line needed to pump water from the Chattahoochee River to Glades Reservoir would not be necessary until sometime after the reservoir is constructed and operational; when additional water might be needed.

Should a draft permit be issued by the Corps for this Application, special permit conditions would be included to address the future timing of construction of the various system components. This special conditional permit would require the Permittee to submit documentation to the Corps confirming that water demands within Hall County would exceed existing raw water supplies during the next five to six years. Required documentation would include water use records, a projection of county water demand for the next 10-year period, and any other documentation necessary to confirm that reservoir construction needed to begin in order to meet increasing county water demands. The Permittee would not be allowed to begin construction of any part of the authorized project until receipt of a written notice to proceed from the Corps. The draft permit would also include a similar special condition to address timing for construction of a pumping station on the Chattahoochee River and associated water transmission mains and facilities.

It is assumed that the transmission mains will be constructed at the ultimate peak day capacity, however, the construction of the WTP is assumed to be phased in increments to defer construction costs (**Figure 2.38**). Phasing is assumed based on the total plant capacity and reasonable phasing of multiple treatment trains for incremental capacity increase. For example, a 63-mgd WTP may be constructed in three phases and each at 21-mgd capacity. In this instance, it also is assumed that total land area for the 63-mgd WTP will be acquired to allow for future expansion.

Table 2.44 Approximate Implementation Timeline

Glades Reservoir	
Design and permit to construct	2 years
Land acquisition[1] & funding	2 years
Bidding and construction	3 years
Filling of reservoir	1 years
Total	8 years
White Creek Reservoir	
Design and permit to construct	2 years
Land acquisition & funding	3 years
Bidding and construction	3 years
Filling of reservoir	1 years
Total	9 years
River RWPS and Pipeline to Reservoir	
Local permitting, land acquisition & funding	2 years
Design and permit to construct	1 years
bidding and construction	2 years
Total	5 years
Reservoir PS and Pipeline Lakeside WTP	
Design and permit to construct	2 years
Land acquisition & funding	2 years
Bidding and construction	3 years
Total	7 years
Reservoir PS and Pipeline New Glades WTP	
Design and permit to construct	1 years
Land acquisition & funding	1 years
Bidding and construction	1 years
Total	3 years
New Glades WTP	
Design and permit to construct	2 years
Land acquisition, bidding and construction	3 years
Total	5 years

1. Hall County currently owns the land for the 850-acre Glades Reservoir area. Therefore, the time is for funding rather than land acquisition for all Glades Reservoir alternatives.

Draft Environmental Impact Statement

Figure 2.38 Estimated Construction Schedules by Alternative

ALTERNATIVES IMPLEMENTATION SCHEDULE

ALTERNATIVE#		START	FINISH
Lake Lanier Allocation: 18 mgd			
Applicant	L18-G50-PT		
	Glades Reservoir with a safe yield of 50 mgd	2017	2025
	River RWPS (36.5 mgd) and Pipeline to Reservoir (4.1 mile)	2035	2040
	Lakeside WTP expansion (77 mgd capacity)	2032	2035
1	L18-G42-PT		
	Glades Reservoir with a safe yield of 42 mgd	2017	2025
	River RWPS (28 mgd) and Pipeline to Reservoir (4.1 mile)	2035	2040
	Lakeside WTP expansion (65mgd capacity)	2032	2035
2	L18-G42-PL		
	Glades Reservoir with a safe yield of 42 mgd	2017	2025
	River RWPS (31 mgd) and Pipeline to Reservoir (4.1 mile)	2035	2040
	Reservoir PS (63 mgd), booster PS (63 mgd) and Pipeline (25.4 mile) to Lakeside WTP	2018	2025
	Lakeside WTP expansion (65mgd capacity)	2032	2035
3	L18-G42-WTP		
	Glades Reservoir with a safe yield of 42 mgd	2017	2025
	River RWPS (31 mgd) and Pipeline to Reservoir (4.1 mile)	2035	2040
	Reservoir PS (63 mgd) and Pipeline (0.1 mile) to New Glades WTP	2022	2025
	New Glades WTP (63 mgd)	2022	2040
Lake Lanier Allocation: 30 mgd			
4	L30-G30-PT		
	Glades Reservoir with a safe yield of 30 mgd	2032	2040
	River RWPS (15mgd) and Pipeline to Reservoir (4.1 mile)	2045	2050
	Lakeside WTP expansion (65mgd capacity)	2032	2035
5	L30-G30-PL		
	Glades Reservoir with a safe yield of 30 mgd	2032	2040
	River RWPS (18.5 mgd) and Pipeline to Reservoir (4.1 mile)	2045	2050
	Reservoir PS (45 mgd), booster PS (45 mgd) and Pipeline (25.4 mile) to Lakeside WTP	2033	2040
	Lakeside WTP expansion (65mgd capacity)	2032	2035
6	L30-G30-WTP		
	Glades Reservoir with a safe yield of 30 mgd	2032	2040
	River RWPS (18.5 mgd) and Pipeline to Reservoir (4.1 mile)	2045	2050
	Reservoir PS (45 mgd) and Pipeline (0.1 mile) to New Glades WTP	2037	2040
	New Glades WTP (45 mgd)	2036	2050
Lake Lanier Allocation: 43 mgd			
7	L43-G17-PT		
	Glades Reservoir with a safe yield of 17 mgd	2042	2050
	River RWPS (2 mgd) and Pipeline to Reservoir (4.1 mile)	2054	2058
	Lakeside WTP expansion (65mgd capacity)	2032	2035
8	L43-G17-PL		
	Glades Reservoir with a safe yield of 17 mgd	2042	2050
	River RWPS (5 mgd) and Pipeline to Reservoir (4.1 mile)	2054	2058
	Reservoir PS (26 mgd), booster PS (26 mgd) and Pipeline (25.4 mile) to Lakeside WTP	2044	2050
	Lakeside WTP expansion (65mgd capacity)	2032	2035
9	L43-G17-WTP		
	Glades Reservoir with a safe yield of 17 mgd	2042	2050
	River RWPS (5 mgd) and Pipeline to Reservoir (4.1 mile)	2054	2058
	Reservoir PS (26 mgd) and Pipeline (0.1 mile) to New Glades WTP	2047	2050
	New Glades WTP (26-mgd)	2045	2058
10	L43-W17-PT		
	White Creek Reservoir with a safe yield of 17 mgd	2041	2050
	River RWPS (15 mgd) and Pipeline to Reservoir (0.5 mile)	2046	2050
	Lakeside WTP expansion (65mgd capacity)	2032	2035
11	L43-W17-PL		
	White Creek Reservoir with a safe yield of 17 mgd	2041	2050
	River RWPS (18.5 mgd) and Pipeline to Reservoir (0.5 mile)	2046	2050
	Reservoir PS (26 mgd), booster PS (26 mgd) and Pipeline (21.5 mile) to Lakeside WTP	2043	2050
	Lakeside WTP expansion (65mgd capacity)	2032	2035

2.7.2 Temporary Sediment and Erosion Control

The proposed approach for sediment and erosion control is the same for all alternatives that involve construction. Prior to construction, the Applicant, or its contractor, would obtain an appropriate land disturbance permit and a National Pollutant Discharge Elimination System (NPDES) Discharge Permit for Construction Activities from the GDNR. The permit would require development of an Erosion, Sedimentation, and Pollution Control Plan to prevent and control erosion from stormwater runoff and subsequent downstream water quality degradation. The permit and plan would remain in effect until the exposed areas have been re-vegetated and stabilized.

2.7.3 Dam and Reservoir Construction Methods

Based on typical dam construction processes and rates, it is expected that it may take two to three years to complete the construction processes for the dam and its appurtenances (spillway, outlet works, access roads, etc.). Initial filling of the reservoir will depend on hydrologic conditions following construction completion.

The construction process will begin with the construction contractor's (Contractor) submittal and receipt of approval of local permits including drainage, dust control, traffic plans, etc. and developing site access, contractor staging areas (office trailers and equipment and material storage areas), control and management of streamflows through the construction site and reservoir clearing in accordance in accordance with the conditions defined in federal and state permits. The locations of the Contractor's staging areas are generally constrained to areas within or immediately adjacent to the construction areas to minimize additional land disturbance.

The Contractor will then begin excavation for the foundation of the dam appurtenances and the development of the borrow areas (soil and rock excavation for materials to be used in the dam and concrete structures). Typical requirements in the bid documents issued to prospective contractors and incorporated in the Contractor's contract will require segregation, stockpile and protection of topsoil for use in restoring disturbed areas following construction. Not all excavated soil and rock will be suitable for use in the constructed works and will be properly disposed of with on-site placement executed to provide long-term slope stability and prevention of erosion. Materials not suitable for use in the highly controlled dam structure and its appurtenances are often suitable for use in developing access roads and recreational amenities around the reservoir.

Construction of the dam appurtenances follows formal approval of the structures' foundations by State regulatory personnel. Dam construction is continually monitored for adherence to the contractual plans and specifications throughout the construction program. The great majority of the materials required for project construction will come from within the normal maximum water surface elevation of the reservoir although some construction materials will need to be transported to the construction site (for example, cement for use in making concrete, steel reinforcement bars, asphalt for roads and specialty sands and gravels if it is not practical to produce them from on-site geologic materials).

Water will be required during construction for a variety of needs, including concrete mixing, embankment fill placement, aggregate production, and dust control. Most of this water can be of raw water quality available at or near the construction site with appropriate permits to be obtained by the Contractor. Some trucking of higher quality water may also be required. Initial filling of the reservoir will only occur after formal regulatory approval

of the State and will follow a gradual and carefully monitored program in accordance with current dam construction practices.

2.7.4 Transmission System and Treatment Plant Construction Methods

2.7.4.1 River Intake and Pump Station, Reservoir Intake and Pump Station, Booster Pump Station

The project is expected to cause temporary impacts to a small area of the bed of the Chattahoochee River and reservoir during construction of the water intake structures and pump stations. The impact will be caused by the placement of temporary sheet piling along the bank of the river bed around the area where the bank will be excavated. The sheet piling will act as a dam to keep river water from inundating the construction area, and to prevent sediment and stormwater from the construction area from discharging into the river. During construction, stormwater from the construction area will be pumped from the containment area to stormwater sediment basins on the project site before being released to the river downstream of the site. The sheet piling and any sediment accumulated in the containment area will be removed upon completion of construction of the intake structure and stabilization of the adjacent banks, and the river bed will be restored to its original condition and elevation. The riverbank immediately upstream and downstream of the new intake will be re-vegetated with grassing and slope matting and trees will be planted to stabilize the bank and prevent erosion.

The intake pumping stations are typically separated into four (4) primary areas: deck structure with screening (bar screens and traveling screens) and wet wells, pump room, electrical room, and administration area. The deck structure is typically 6- to 12-inches above grade. The pump room is two stories high and the electrical and administrative areas are one story. Pumps are typically vertical turbine pumps.

The booster pumping stations are within the transmission piping network, rather than within the stream buffers as with the intake pumping stations. In-line booster pumping stations are necessary for transmission mains with long force mains or where the pumping head is elevated above the abilities of a single pumping arrangement. Booster pumping stations are typically two stories high with a pump room and an electrical room. The stations are at grade with transmission main piping coming into the suction side of the pumps and the discharge piping leaving the pumps and leaving the station below grade. Pump types are typically horizontal centrifugal pumps.

2.7.4.2 Transmission Mains

The proposed pipelines associated with the alternatives include potential raw water transmission mains from the Chattahoochee River Pump Stations to a new reservoir (16 to 42-inches in diameter) and raw water transmission mains from the new reservoir sites to a WTP (36 to 60-inches in diameter). The various pipelines would cross highways, railroads, and streams. Given pipe diameters, it is assumed that pipe installation will primarily be via open cut. The assumed construction trench would be 5-10 feet wide depending on the pipe size.

In some critical crossing locations such as railroads, high traffic roads, major pipeline crossings, wetlands and stream crossings, the crossing would be installed by Horizontal Directional Drilling (HDD) to mitigate above ground impacts of construction. HDD is a trenchless methodology that provides an installation alternative for pipelines up to 48-inch in diameter that can offer a number of benefits over traditional open-cut. HDD can be implemented with very little disruption to surface activities, requires less working space, and may be performed more quickly than open-cut methods. Also, it can simplify permitting processes.

For stream crossings with pipelines greater than 48-inch, typically, a semicircular earthen dike would be constructed to confine the river flow to half of the natural channel. The dry half of the channel would be trenched, the pipeline would be installed and the trench would be backfilled. The dike would then be removed and a new dike would be constructed to confine the river flow to the other half of the channel. The remaining trench would be excavated, the pipeline installed, and the trench backfilled, as before. The second dike would be removed and the site would be restored to its approximate original condition.

2.7.4.3 Water Treatment Plant

The conventional WTP is expected to include the following facilities:

- Administration building
- Coagulation, flocculation, sedimentation basins
- Filter building
- Chemical building
- Disinfection building
- Clearwells
- High service pump station building
- Gravity thickeners
- Backwash water holding basin
- Maintenance building

The Administration building is typically a one story building. The chemical building, disinfection building, and high service pump station are typically two stories to accommodate equipment height and clearances. The filter building is one level above grade with a below grade floor for a piping gallery. Clearwells can be either above grade tanks or below grade.

2.7.5 Construction Equipment

A wide variety of machinery would be used in the performance of the construction work for each alternative, such as scrapers, loaders, dozers, compactors, rollers, track hoes, and back hoes. The construction equipment would travel little or no mileage off site on public roads, but they would be running full time during construction activities. **Table 2.45** summarizes typical construction equipment used for the key water supply components in the alternatives.

Table 2.45 Typical Construction Equipment

New Reservoir Construction: 1 air compressor 2 backhoes 2 compactors 2 dozers 4 dump trucks 4 front end loaders 1 fuel truck 2 diesel generators 4 motor graders 10 pickup trucks 8 scrapers 4 water trucks 1 welder 1 tunnel boring machine	New Pump Stations: 2 medium hydraulic excavators (Komatsu or John Deere 400's) 1 roller compactor 1 large bulldozer 1 water truck (20% of project) 4 pickup trucks 2 dump trucks (50% of project) 2 medium rubber tired front end loader 1 fuel truck 2 diesel generator 4 air compressors 1 medium crane (50% of project) 2 concrete trucks (25% of project)
Pipelines 2 medium hydraulic excavators (Komatsu or John Deere 400's) 1 roller compactor 1 medium bulldozer 1 water truck 2 pickup trucks 2 dump trucks 1 HDD drill rig (30% of project) 1 medium rubber tired front end loader 1 fuel truck 1 diesel generator 1 air compressor	New WTP 5 pickup trucks 17 concrete trucks (15% of project) 8 dump trucks (50% of project) 6 track backhoes (75% of project) 2 dozers (20% of project) 4 rubber tire backhoes (75% of project) 4 remote rollers (50% of project) 4 street sweepers (10% of project) 4 Komatsu 320 Loaders (50% of project) 7 hand compactors (30% of project) 6 cranes (30% of project) 2 sheep foot rollers (5% of project)

2.7.6 Construction Traffic

Construction activity will generate vehicle trips related to site-worker commutes and movement of construction equipment, materials and spoils.

It is estimated that construction-related traffic would consist of:

- New Reservoir Construction: Haul trucks would export cut material from the reservoir site on public roads to off-site locations 260 days per year.
- It can be assumed that all construction site-workers will travel to the site with 1.5 persons per vehicle. Each vehicle is expected to generate two trips per day – one arriving to the construction site and one departing the construction site. All construction related trucks are expected to each generate eight trips per day.

Potential mitigation measures are recommended where feasible to avoid or substantially reduce the any significant construction traffic impacts. These measures are generally structured to focus first on avoidance, then reduction and finally compensation to reduce impacts. The engineering design documents will ensure development of site-specific construction traffic management plans (TMP) for each of the projects that address the specific steps to be taken before, during, and after construction to minimize traffic impacts.

- Each TMP will address the following, as needed. Implementation of this measure will ensure operational traffic impacts and delays experienced during construction will be minimized to the greatest extent feasible.
- Signage warning of roadway surface conditions such as loose gravel, steel plates or similar conditions that could be hazardous to road cycling activity on roadways open to bicycle traffic.
- Signage and barricades to be used around the work sites.
- In-water work areas will be indicated by buoys, signage, or other effective means to warn boaters of their presence and restrict access.
- Use of flag people or temporary traffic signals/signage as necessary to slow or detour traffic.
- Notifications for the public, emergency providers, cycling organizations, bike shops, and schools, the U.S. Coast Guard, boating organizations, marinas, city and county parks departments, describing construction activities that could affect transportation and water navigation.
- Outreach (via public meetings and/or flyers and other advertisements)
- Procedures for construction area evacuation in the case of an emergency declared by county or other local authorities.
- Alternate access routes via detours and bridges to maintain continual circulation for local travelers in and around construction zones, including bicycle riders, pedestrians, and boaters, where applicable.
- Description of construction staging areas, material delivery routes, and specification of construction vehicle travel hour limits.
- Designation of areas where nighttime construction will occur.
- Plans to relocate school bus drop-off and pick-up locations if they will be affected during construction.
- Scheduling for oversized material deliveries to the work site and haul routes.
- Provisions that direct haulers are to pull over in the event of an emergency. If an emergency vehicle is approaching on a narrow two-way roadway, specify measures to ensure that appropriate maneuvers will be conducted by the construction vehicles to allow continual access for the emergency vehicles at the time of an emergency.
- Control for any temporary road closure, detour, or other disruption to traffic circulation, including any temporary partial water channel closures.
- Designated offsite vehicle staging and parking areas.
- Posted information for contact in case of emergency or complaint.
- Other actions to be identified and developed as may be needed by the construction manager/resident engineer to ensure that temporary impacts on transportation facilities are minimized.

2.7.7 Construction Workforce

Construction activities associated with each of the alternatives would provide temporary employment for full-time workers. Employment would occur over different periods of time for each alternative. In general, the labor force would consist of heavy equipment operators, general laborers, carpenters, ironworkers, surveyors, and electricians. It is assumed that the majority of the labor force would be hired locally (within a 60-mile radius of the various construction sites). Non-local workers would seek housing in the Hall County area. The work force at the various construction sites would vary depending on the phase of construction. Most work would be performed during the day; however, double or triple shifts up to 24 hours per day operation would be possible. **Table 2.46** shows the estimated number of workers by component for each action alternative, including a 20% contingency.

Table 2.46 Construction Manpower Estimate (Full-time Equivalent Workers)

New Reservoir Construction Daily Average – 75 Quarterly Peak – 142	New Pump Stations Daily Average – 16 Quarterly Peak – 25
Pipelines Daily Average – 11 Quarterly Peak – 11	New WTP Daily Average – 70 Quarterly Peak – 70

2.7.8 Post-Construction Activities

Post-construction, a daily workforce would be required to operate and maintain the Proposed Project facilities. It is assumed that a full-time staff would be required to operate any of the conceptual reservoir facilities including the reservoir, water treatment plant, pipelines and pump stations. The pipelines are unlikely to require daily operational activities. However, maintenance staff will be required to routinely inspect appurtenances of the pipeline such as in-line valves, blow-offs, and air release/vacuum valves which are typically housed in vaults below grade. The pump stations could be operated remotely as un-manned facilities assuming that the County is able to connect the facilities to their Supervisory Control and Data Acquisition (SCADA) network and allows for remote start/stop of the pumps and monitoring. This could easily be accomplished through fiber optic network connection of the facility or radio telemetry.

Other part-time staff from the County's current public works department may be needed to perform watershed protection and water quality monitoring activities, in addition to maintenance of access roads to the facilities and grounds at the facilities.

2.8 EIS Alternatives Preliminary Engineering: Estimated Cost of Build Alternatives

Capital costs for construction were developed from feasibility-level concepts of the components for each alternative. These costs include materials, supplies, labor, contractor mobilization, and contractor overhead. Contingency factors and engineering costs are also incorporated into capital costs. Costs associated with right-of-way acquisitions or easements have also been preliminary estimated and are included in the capitol costs. Costs for each build alternative are compared in **Table 2.47**. The estimated capital costs include construction costs for all water supply infrastructure components, including reservoir, pump station, transmission mains and treatment plant expansion. The cost estimates do not include cost for future distribution system expansion. All

alternatives will require distribution system expansion and the scope of modification and expansion will vary depending on the number of finished water sources in the alternative. The cost can only be adequately estimated with distribution system modeling.

Table 2.47 Estimated Costs of Build Alternatives

#	Alternative	Total Cost
Applicant	L18-G50-PT	$ 166,000,000
1	L18-G42-PT	$ 147,000,000
2	L18-G42-PL	$ 344,000,000
3	L18-G42-WTP	$ 296,000,000
4	L30-G30-PT	$ 138,000,000
5	L30-G30-PL	$ 316,000,000
6	L30-G30-WTP	$ 232,000,000
7	L43-G17-PT	$ 124,000,000
8	L43-G17-PL	$ 263,000,000
9	L43-G17-WTP	$ 157,000,000
10	L43-W17-PT	$ 175,000,000
11	L43-W17-PL	$ 338,000,000

Note: Estimated costs include treatment plant expansion but do not include distribution system expansion. All alternatives will require distribution system expansion and the scope of modification and expansion will vary depending on the number of finished water supply sources in the county.